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*Why ask for the moon  
When we have the stars?*

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# Materia Photographica

A Dictionary of the Chemicals, Raw  
Materials, Developing Agents  
and Dyes used in  
Photography

BY

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PHILADELPHIA

FRANK V. CHAMBERS, *Publisher*

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THE intent and purpose of the author of the ensuing pages which are devoted to consideration of the "Materia Photographica" employed in the photographic art, is to present an exhaustive dictionary of the raw materials, chemical bodies, as well as the specific dyes and developing agents necessary to a complete performance in the various provinces of photography.

There has been a longing desire on the part of the practical manipulator, as well as the experimentalist, to have a sort of *vade mecum* of this kind, concise, yet comprehensive, and withal intelligible to those not essentially scientific chemists. There is no work in America which undertakes this problem, and this book will, therefore, fill the requirements completely. The author is thoroughly conversant with the topic under treatment and has labored strenuously to insure accuracy in the detail information and to explore thoroughly the entire field of operation.

It is, therefore, something indispensable, not only to the experimentalist, but of pertinent value to the entire profession.

THE PUBLISHER.

## INTERNATIONAL ATOMIC WEIGHTS

	Symbol	Atomic Weight
Aluminum.....	Al	27.1
Antimony.....	Sb	120.2
Argon.....	A	39.9
Arsenic.....	As	74.96
Barium.....	Ba	137.37
Bismuth.....	Bi	208.0
Boron.....	B	10.9
Bromine.....	Br	79.92
Cadmium.....	Cd	112.40
Calcium.....	Ca	40.07
Carbon.....	C	12.005
Cerium.....	Ce	140.25
Cesium.....	Cs	132.81
Chlorine.....	Cl	35.46
Chromium.....	Cr	52.0
Cobalt.....	Co	58.97
Columbium.....	Cb	93.1
Copper.....	Cu	63.57
Dysprosium.....	Dy	162.5
Erbium.....	Er	167.7
Europium.....	Eu	152.0
Fluorine.....	F	19.0
Gadolinium.....	Gd	157.3
Gallium.....	Ga	70.1
Germanium.....	Ge	72.5
Glucinum.....	Gl	9.1
Gold.....	Au	197.2
Helium.....	He	4.00
Holmium.....	Ho	163.5
Hydrogen.....	H	1.008
Indium.....	In	114.8
Iodine.....	I	126.92
Iridium.....	Ir	193.1
Iron.....	Fe	55.84
Krypton.....	Kr	82.92
Lanthanum.....	La	139.0
Lead.....	Pb	207.20
Lithium.....	Li	6.94



	Symbol	Atomic Weight
Lutecium.....	Lu	175.0
Magnesium.....	Mg	24.32
Manganese.....	Mn	53.93
Mercury.....	Hg	200.6
Molybdenum.....	Mo	96.0
Neodymium.....	Nd	144.3
Neon.....	Ne	20.2
Nickel.....	Ni	58.68
Niton (radium emanation).....	Nt	222.4
Nitrogen.....	N	14.008
Osmium.....	Os	190.9
Oxygen.....	O	16.00
Palladium.....	Pd	106.7
Phosphorus.....	P	31.04
Platinum.....	Pt	195.2
Potassium.....	K	39.10
Praseodymium.....	Pr	140.9
Radium.....	Ra	226.0
Rhodium.....	Rh	102.9
Rubidium.....	Rb	85.45
Ruthenium.....	Ru	101.7
Samarium.....	Sa	150.4
Scandium.....	Sc	45.1
Selenium.....	Se	79.2
Silicon.....	Si	28.3
Silver.....	Ag	107.88
Sodium.....	Na	23.00
Strontium.....	Sr	87.63
Sulphur.....	S	32.06
Tantalum.....	Ta	181.5
Tellurium.....	Te	127.5
Terbium.....	Tb	159.2
Thallium.....	Tl	204.0
Thorium.....	Th	232.15
Thulium.....	Tm	168.5
Tin.....	Sn	118.7
Titanium.....	Ti	48.1
Tungsten.....	W	184.0
Uranium.....	U	238.2
Vanadium.....	V	51.0
Xenon.....	Xe	130.2
Ytterbium (Neoytterbium).....	Yb	173.5
Yttrium.....	Yt	89.33
Zinc.....	Zn	65.37
Zirconium.....	Zr	90.6

### ABBREVIATIONS USED IN DESCRIBING MATERIALS

- A.P.—Average price
- A.W.—Atomic weight
- B.P.—Boiling point
- Der.—Derivation
- Fr.—French
- Ger.—German
- G.—Grade suitable for photographic use
- Ins.—Insoluble
- M.P.—Melting point
- M.W.—Molecular weight
- P.—Properties
- Sap.—Soluble in all proportions
- Sol.—Soluble
- Sp.G.—Specific Gravity
- Ss.—Slightly soluble
- Syn.—Synonym
- U.P.—Uses in photography
- C.P.—Chemically pure
- U.S.P.—United States Pharmacopœia

## MATERIA PHOTOGRAPHICA

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### General Chemicals and Raw Materials

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#### ACETONE, $(\text{CH}_3)_2\text{CO}$

Fr. Acétone; Ger. Aceton

Syn. Dimethyl-ketone, Ketopropane, Methylacetal, Propanone, Pyroacetic ether.

M. W. 58: Sp. G. about  $0.798^\circ$ : M. P.  $94.3^\circ\text{C}$ : B. P.  $56.48^\circ\text{C}$ .

Sol. in water, alcohol and ether.

P. Colorless liquid, mint-like odor, highly volatile and inflammable. Should be kept in well stoppered bottles in a cool place.

Der. By dry distillation of calcium acetate also as a by-product in the manufacture of butyl alcohol. Purified by rectification.

G. Technical; U.S.P. (98% Acetone). Should not show more than a trace of acidity.

U. P. Solvent for resins, collodion, nitrocellulose; used in manufacture of sheet celluloid, varnishes and film cements, can be used as a substitute for the alkali in pyro or hydroquinone developers.

The acid amidol developer can be remarkably energized by the addition of from 3 to 5% acetone.

#### ACETONE SULPHITE, $\text{NaHSO}_3 (\text{CH}_3)_2\text{CO H}_2\text{O}$

Fr. Acétone Sulfite; Ger. Acetonsulphit

M. W. 162.

Sol. in water; Ss. in alcohol.

P. Fine white Powder.

Der. Acetone combined with acid sodium sulphite.

- U. P. Substitute for sodium sulphite and the metabisulphites in development. 10 parts acetone sulphite are equal to 7.5 parts of potassium metabisulphite or 20 parts of dry sodium sulphite.

As a preservative of pyro,  $\frac{1}{2}$  ounce of acetone sulphite is added for each ounce of pyro used. Keeps fixing baths clear and colorless.

### ACID ACETIC, $\text{HC}_2\text{H}_3\text{O}_2$

Fr. Acide Acétique; Ger. Essigsäure

Syn. Acid methanecarboxylic, Vinegar acid, Purified Pyro-ligneous acid.

M. W. 60; M.P.  $16.7^\circ\text{C}$ : B.P.  $118.1^\circ\text{C}$ .

Sol. in water, alcohol, ether, chloroform and glycerine.

P. Colorless liquid, sour pungent smell, vapor inflammable, congeals at  $15.65^\circ\text{C}$ .

Der. Prepared from wood by destructive distillation, also by the oxidation of dilute ethyl alcohol, governed by bacterial action.

G. Two grades commonly used in photography, Glacial Acetic Acid, U.S.P. (99% acetic acid) Sp. G. about 1.065, congeals at about  $12.8^\circ\text{C}$ . hence the name glacial (or ice like) acetic acid. Commercial grade (28% acetic acid) Sp. G. 1.038; This strength acid can be easily prepared from the glacial acid by dilution with distilled water. Glacial acetic acid is a strong escharotic, if spilt on the skin should be washed off at once. The impurities often found in acetic acids are sulphurous acid, tarry matters, hydrochloric or sulphuric acid. Samples which yield a precipitate when a drop of silver nitrate solution is added to a quarter of an ounce, or which discolor when the mixture is exposed to light, should be rejected.

U. P. Preparation of acid fixing baths. As a clearing bath after ferrous oxalate development of bromide paper. Used in the uranium toning bath facilitates the penetration of the gelatine by the bath. Solvent for gelatine, celluloid, pyroxyline. Used in the manufacture of cellulose acetate. Preparation of gelatine substratum.



**ACID BENZOIC,  $C_6H_5COOH$** 

Fr. Acide Benzoïque.; Ger. Benzoessäure

Syn. Acid phenylformic.

M. W. 122: Sp. G. 1.2659: M. P. 121.25°C. B. P. 249.2°C.

Sol. in alcohol and ether; Ss. in water. Freely soluble in chloroform or benzene.

P. White voluminous crystalline plates or needles. Aromatic odor.

Der. From gum benzoin by sublimation. Industrially, by the chlorination of toluol, heating this under pressure with milk of lime. The benzoic acid is distilled off by steam and crystallized.

G. U.S.P. from benzoin.

U. P. Has been used as a preservative in photographic emulsions, used in toning baths and for the sizing and surfacing of photographic paper.

**ACID BORIC,  $H_3BO_3$** 

Fr. Acide Borique; Ger. Borsäure

Syn. Acid boracic, Acid orthoboric.

M. W. 62: Sp. G. 1.4347: M. P. 184°C.

Sol. in water, alcohol, glycerine, and volatile oils.

P. White shining scales or amorphous powder.

Der. By the addition of hydrochloric or sulphuric acid to a solution of borax and crystallizing.

G. U.S.P. crystal or powder.

U. P. Used in pyro developers as a restrainer and to prevent stains, can also be used in the fixing bath as a stain preventer. A solution of 1 part boric acid in 30 parts of water acts as a stop bath, stopping development instantly.

**ACID CARBOLIC (Phenol),  $C_6H_5OH$** 

Fr. Acide Phénique; Ger. Karbolsäure

Syn. Phenic acid, Phenyl hydrate, Hydroxybenzene.

M. W. 94: Sp. G. 1.0677: M. P.  $42.5^{\circ}C$ : B. P.  $182.6^{\circ}C$ .

Sol. in water, alcohol, ether, chloroform, glycerine and alkalis.

P. White crystalline mass, turns pink or red if not pure, absorbs water from the air and liquefies, has sharp burning taste and distinctive odor, strong corrosive poison.

Der. By treating coal tar oil fraction, boiling between  $170^{\circ}$  and  $230^{\circ}C$ . with caustic soda to form phenolate. The solution is purified by removing the naphthalene, treated with acid to set the phenol free which is further purified by distillation. It can also be prepared by converting benzol into sulphonic acid and fusing the latter with caustic soda. On treating the sulphonate with acid, pure phenol is released.

G. U.S.P. crystal or fused.

U. P. Used as a preservative for photographic emulsions, gelatine solutions, and mountants. It is the starting point of many of the photographic chemicals, developers and dyes.

**ACID CHROMIC (Anhydride),  $CrO_3$** 

Fr. Acide Chromique; Ger. Chromsäure Anhydrid

Syn. Chromium trioxide.

M. W. 100: Sp. G. 2.67: M. P.  $196^{\circ}C$ .

Sol. in water.

P. Reddish brown crystals. Violently explodes when brought into contact with organic substances. Highly poisonous.

Der. Hydrochloric or sulphuric acid added to a solution of sodium bichromate and the product recovered by recrystallization.

G. C.P.

U. P. Principal use in process work in the fish glue process. Used in conjunction with sulphuric acid for clearing the fish glue image previous to etching, removing any scum from between the half-tone dots.

**ACID CITRIC,  $(\text{CO}_2\text{HCH}_2)_2\text{C}(\text{OH})\text{CO}_2\text{H}$** 

Fr. Acide Citrique; Ger. Citronensäure

Syn. Acid oxytricarballic.

M. W. 210; Sp. G. 1.542; M. P.  $153^\circ\text{C}$ .

Sol. in water, alcohol and ether.

P. Colorless, odorless crystals, with characteristic lemon flavor.

Der. Crude citric acid is obtained from lemons or other citrus fruit, then neutralized with calcium carbonate and the lime salt dissociated with sulphuric acid. The product is then filtered, evaporated and recovered by crystallization. Tartaric acid is the most likely impurity to be expected.

G. U.S.P. crystal or powder.

U. P. Citric acid can be used as a preservative in some developing solutions and in others acts as a restrainer. Can be used for making acid fixing baths and as a preservative in emulsions. 1 part citric acid to 100 of water is an excellent clearing bath for removing the yellow pyro stain from negatives. Used in the preparation of gelatino-citro-chloride printing-out paper.

Citric acid can be used to replace acetic acid in photographic solutions. 1 oz. of citric acid is equivalent to 2 ozs. of 28% acetic acid. Citric acid will replace glacial acetic acid weight for weight.

**ACID DIGALLIC (Tannin),  $\text{C}_{14}\text{H}_{10}\text{O}_9$** 

Fr. Acide Tannique; Ger. Gerbsäure

Syn. Acid gallotannic.

M. W. 322; M. P. Decomposes at  $210^\circ\text{C}$ .

Sol. in water and alcohol; Ss. in ether.

P. Lustrous, faintly yellow amorphous powder.

Der. Extracted from powdered gall nuts with water and alcohol, then evaporated and purified by crystallization.

G. U.S.P.

U. P. Principal use in process work as an ingredient in the etching solution for collotype plates acting as a hardener of the gelatine. Has been recommended as a hardening agent for prints and negatives, but is likely to give some stain.

**ACID FORMIC,  $\text{HCOOH}$   $\text{H}_2\text{CO}_2$** 

Fr. Acide Formique; Ger. Ameisensäure

Syn. Acid hydrogen carboxylic.

M. W. 46: Sp. G. 1.2178: M. P.  $8.3^\circ \text{C}$ .; B. P.  $100.8^\circ \text{C}$ .

Sol. in water, alcohol and ether.

P. Colorless liquid, pungent odor, very strong caustic.

Der. By dissociation of sodium formate with mineral acid, then by distillation and absorption in distilled water. Purified by rectification.

G. U.S.P. 75%.

U. P. Comparatively unimportant in photography. Is sometimes used in process work instead of acetic acid for stripping of wet collodion negatives. Its disadvantage is, however, its dangerous caustic properties.

**ACID GALLIC,  $\text{C}_6\text{H}_2(\text{OH})_3\text{CO}_2\text{H} \cdot \text{H}_2\text{O}$  3:4:5**

Fr. Acide Gallique; Ger. Gallussäure

Syn. Acid Trioxybenzoic, Acid Trihydroxybenzoic.

M. W. 188.06: Sp. G. 1.694: M. P.  $220^\circ$  to  $240^\circ \text{C}$ .

Sol. in alcohol; Ss. in water and ether.

P. Slightly yellow or colorless crystalline needles or prisms.

Der. Obtained by fermentation from powdered galls or by boiling tannin with dilute acid or caustic soda.

G. U.S.P.

U. P. Not very much used in modern photography. In the early days of photography, was used as a developer for paper negatives. At the present time is occasionally used in the development of P. O. P., intensification of collodion and gelatine negatives, and as one of the ingredients in the ferrous citrate developer for chloride plates. Is used by lithographers for preparing the surface of zinc plates for printing.



**ACID HYDROBROMIC, HBr in Aqueous Solution**

Fr. Acide Bromhydrique; Ger. Bromwasserstoffsäure

Syn. Hydrogen bromide, Bromhydric acid.

M. W. 81: Sp. G. 1.38.

Sol. in water.

P. Faintly yellow or clear colorless liquid.

Der. Made by passing hydrogen with bromine vapor over a warm platinum sponge which acts as a catalyzer and then collecting by absorption in water.

G. U.S.P. (40% HBr.)

U. P. Used in the production of some of the bromides used in photography. Sometimes added to emulsions as a preservative. Small additions of hydrobromic acid will cure fog in an emulsion, at the same time decreasing the emulsion speed.

**ACID HYDROCHLORIC, HCl**

Fr. Acide Chlorhydrique; Ger. Chlorwasserstoffsäure

Syn. Muriatic acid, Hydrogen chloride.

M. W. 36.5: Sp. G. 1.16.

Sol. in water, miscible in all proportions with alcohol and water.

P. Clear, colorless or slightly yellow. Fuming pungent liquid, poisonous.

Der. Usually made by the action of sulphuric acid on common salt. Also as a by-product of the LeBlanc soda process.

G. U.S.P. (33% HCl.)

U. P. Generally used as a clearing bath for pyro stains and as a clearing bath in the platinotype process. Is used in connection with vanadium, iron and the copper toning processes.

The addition of HCl to chloride emulsions increases speed, also tends to make such emulsions clean working and free from fog.

**ACID HYDROFLUORIC, HF**

Fr. Acide Fluorhydrique; Ger. Fluorwasserstoffsäure

Syn. Hydrogen fluoride, Fluoric acid.

M. W. 20.

P. Clear, colorless fuming corrosive liquid. Very dangerous to handle. Dissolves the nails and produces terrible sores if allowed to come in contact with the skin.

Der. Calcium fluoride is treated with sulphuric acid, the mixture distilled in a platinum retort. Hydrofluoric acid gas passes over and is dissolved in distilled water.

G. Technical. 52% HF.

U. P. Its principal use in photography is for stripping films from glass plates; a 2 to 3% solution being used. It is also used in hyalography or photographic etching on glass.

**ACID LACTIC,  $\text{CH}_3\text{CH}(\text{OH})\text{COOH}$** 

Fr. Acide Lactique; Ger. Milchsäure

Syn. Acid alpha-hydroxypropionic and acid ethylidenelactic.

M. W. 90: Sp. G. 1.2485.

Sol. in water, alcohol and ether.

P. Yellow or colorless thick liquid.

Der. Obtained very largely from sugar by the lactic ferment.

G. U.S.P. 75% lactic acid.

U. P. Occasionally used in the preparation of silver lactate positive emulsions. Acts as a preservative for slow chloride emulsions and prevents fog. Is a useful preservative for amidol developer in the proportion of 5cc. lactic acid to 1000cc. developer. A 3% solution can be used as a stop bath for arresting development.

**ACID NITRIC,  $\text{HNO}_3$** 

Fr. Acide Nitrique; Ger. Salpeteraure

Syn. Aqua fortis, Hydrogen nitrate, Acid azotic.

M. W. 63.02: Sp. G. 1.42: B. P. 86°C.

Sol. in water and alcohol.

P. Transparent, colorless, fuming, suffocating, caustic and corrosive liquid. Causes very painful burns.

Der. Prepared by distillation from saltpetre and sulphuric acid.

G. U.S.P.

U. P. Nitric acid is the principal ingredient in the nitration of cotton for nitrocellulose. Used as a preservative in pyro developer. Used in the production of silver nitrate and in some of the vanadium or iron toning baths. In process work, nitric acid is largely used as a mordant for etching zinc.

### ACID OXALIC, $\text{CO}_2\text{H}.\text{CO}_2\text{H}.2\text{H}_2\text{O}$

Fr. Acide Oxalique; Ger. Oxalsäure

M. W. 126.05: Sp. G. 1.653: M. P.  $187^\circ\text{C}$ .

Sol. in water, alcohol and ether.

P. Transparent, colorless crystals; poisonous.

Der. Sodium carbonate, heated under pressure with carbon dioxide, produces sodium formate. This heated with sodium carbonate, yields sodium oxalate. A calcium salt is added to precipitate calcium oxalate which, when treated with sulphuric acid, gives oxalic acid.

G. C.P.

U. P. Used in the sensitizing of platinotype paper. As a preservative for pyro developer. Used for making corrections on blue prints, as it dissolves the prussian blue image. Used in the preparation of ferrous oxalate developer. With some developers oxalic acid acts as a restrainer.

### ACID PHOSPHORIC, $\text{H}_3\text{PO}_4$

Fr. Acide Phosphorique; Ger. Phosphorsäure

Syn. Ortho-phosphoric acid.

M. W. 98.06: Sp. G. 1.750: M. P.  $38.6^\circ\text{C}$ .

Sol. Miscible in all proportions with water and alcohol.

P. Clear, colorless, syrupy liquid.

Der. Obtained by oxidizing white phosphorous, first in air and then with nitric acid and evaporating the solution.

G. U.S.P. 85 to 88% phosphoric acid.

U. P. A 20% solution of phosphoric acid is frequently employed for acidulating platinum toning baths and in the preparation of silver phosphate emulsions.

**ACID PICRIC,  $C_6H_2(NO_2)_3OH$** 

Fr. Acide Picrique; Ger. Pikrinsalpeters

Syn. Acid picronitric, Trinitrophenol.

M. W. 229.05; Sp. G. 1.767; M. P. 122°C.

Sol. in water, alcohol and ether.

P. Very poisonous and highly explosive, especially when in contact with metals or metallic oxides. Yellow crystals.

Der. By the nitration of monochlorobenzol in presence of sulphuric acid.

G. U.S.P.

U. P. Used in the preparation of nonhalation plates and is sometimes used for making color filters.

**ACID SALICYLIC,  $C_6H_4(OH)(COOH)$** 

Fr. Acide Salicylique; Ger. Salicilsäure

Syn. Acid ortho-hydroxybenzoic.

M. W. 138; Sp. G. 1.483; M. P. 156°C.

Sol. in alcohol and ether; Ss. in water.

P. White crystals.

Der. By the addition of hydrochloric acid to a solution of sodium salicylate, then by filtration and drying, purified by sublimation.

G. U.S.P.

U. P. Used as a preservative in emulsions and for the preservation of mounting paste.

**ACID SULPHURIC,  $H_2SO_4$** 

Fr. Acide Sulfurique; Ger. Schwefel Säure

Syn. Oil of vitriol.

M. W. 98.09; Sp. G. 1.84; M. P. 10.46°C.: B. P. 210 to 338°C.

Sol. in water with evolution of heat.

P. Strongly corrosive, dense, oily, liquid; colorless when pure. It is intensely corrosive and chars all organic matter which it comes in contact with. In mixing always add the acid slowly to the water, not the water to the acid.



- Der. Made by Chamber Process by roasting pyrites or sulphur in specially designed furnaces, or by the catalytic process, the raw materials in this process being sulphur dioxide from pyrites, or sulphur and oxygen from the air to produce sulphur trioxide which is absorbed in water yielding sulphuric acid. The catalyzers most in use are spongy platinum and iron oxide. Purified by distillation.
- G. U.S.P.
- U. P. Sometimes used as a preservative in pyro developer. Used in conjunction with nitric acid for the preparation of nitrocellulose. Is one of the ingredients in the various permanganate, persulphate, bichromate of potassium bleaching and reducing solutions.

### ACID SULPHUROUS, $\text{H}_2\text{SO}_3$

Fr. Acide Sulfureux. Ger. Schweflige Säure

- Syn. Sulphur dioxide, Sulphurous anhydride, Hydric sulphite.
- M. W. 83; Sp. G. 1.025.
- Sol. in water.
- P. Colorless liquid with suffocating sulphur odor.
- Der. Pyrites are calcined and the gas absorbed in water, the liquor then concentrated by means of a still.
- G. U.S.P. (6%).
- U. P. Sometimes used as a preservative for pyro developer and to acidify the fixing bath. It must be freshly prepared as on keeping it very quickly changes into sulphuric acid.

### AGAR-AGAR

Fr. and Ger. Agar-Agar.

- Syn. Japanese gelatine, Chinese isinglass, Layor Carang.
- P. Transparent strips similar in appearance to shredded gelatine.
- Der. Agar-Agar is a gelatinous vegetable material made from several of the white sea weeds (*gracilaria lichenoides* and *eucheuma spinosum*.) These sea weeds are found principally in the Pacific and Indian Oceans and the Japan Sea.
- G. U.S.P.

- U. P. Agar-Agar has been used at different times as a substitute for gelatine in emulsion-making. It is, however, more difficult to melt than gelatine and a good deal harder to handle. It has been used as a substitute for arrowroot in the preparation of silver paper. In process work Agar-Agar is sometimes used as a substitute for fish glue in the process of preparing the resist for etching.

### ALBUMEN

Fr. Albumine. Ger. Albumen.

- P. Almost colorless gummy liquid, which dries to a pale yellow solid similar looking to many of the gums.
- Der. Is an exceedingly complex organic compound and is obtained from blood, milk or eggs. In photography, only the egg albumen is used. This is prepared by separating the fresh white of egg from the yolk, diluting with water, beating to a froth, filtering and evaporating. Albumen is coagulated by heat at  $65.5^{\circ}$  C. It is also coagulated by alcohol and most inorganic salts. It is easily decomposed and must be used directly after preparation, otherwise a preservative must be added.
- G. Technical.
- U. P. Used in the preparation of albumenized paper and various positive processes. In process work is used as a substratum, and is used in conjunction with potassium bichromate for sensitizing zinc plates in photo etching. Albumen also has the property of clarifying solutions of gelatine.

### ALCOHOL ETHYL, $C_2H_5OH$

Fr. Alcool Ethylique. Ger. Aethylalkohol

- Syn. Grain alcohol, Fermentation alcohol, Cologne spirits, Spirits of wine, Ethyl hydrate.
- M. W. 46: Sp. G. .785: M. P.— $112.3^{\circ}$  C.: B. P.  $78.4^{\circ}$  C.
- Sol. in water, methyl alcohol and ether.
- P. Colorless, volatile liquid, vinous odor.
- Der. Prepared by fermentation of the sugars derived from starch.
- G. Cologne spirits containing 95 to 96% alcohol.
- U. P. Used in the preparation of collodion and sometimes in the manufacture of celluloid; is frequently used as an addition to photographic emulsions, where it acts as a preservative. When present at the time of emulsification, has considerable influence on the formation of the silver halide grain, keeping it fine and uniform.

**ALCOHOL METHYL, CH<sub>3</sub>OH**

Fr. Alcool Méthylique. Ger. Methyl Alkohol

Syn. Wood alcohol, Wood naphtha, Methyl hydrate, Columbian Spirits.

M. W. 32: Sp. G. .7913: M. P.—97.8° C.: B. P. 66.78° C.

Sol. in water, alcohol and ether.

P. Colorless, volatile liquid, highly poisonous.

Der. Obtained by the destructive distillation of wood. Purified by rectification.

G. U.S.P.

U. P. One of the solvents frequently employed in the manufacture of celluloid. Is an excellent solvent for resins. Is sometimes used to prepare very concentrated solutions of developers. Used for denaturing ethyl alcohol. Its use, in connection with photographic emulsions, is dangerous, as it produces fog.

**ALUM-AMMONIA, Al<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>(NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>.24H<sub>2</sub>O**

Fr. Alun d'Ammoniaque. Ger. Ammoniakalaun

Syn. Aluminum-Ammonium sulphate.

M. W. 906: Sp. G. 1.645: M. P. 94.5° C.

Sol. in water; Ins. in alcohol.

P. Colorless crystals.

Der. Obtained by crystallization from a mixture of aluminum and ammonium sulphates. Purified by recrystallization.

G. U.S.P. (Lump, ground or powdered).

U. P. Used in the preparation of acid fixing baths and sometimes as a hardener for gelatine.

**ALUM CHROME, K<sub>2</sub>SO<sub>4</sub>Cr<sub>2</sub>(SO<sub>4</sub>)<sub>3</sub>.24H<sub>2</sub>O**

Fr. Alun de Chrome. Ger. Chromalaun

Syn. Chromium and potassium sulphate.

M. W. 916.

Sol. in water; Ins. in alcohol and ether.

P. Violet colored crystals yielding a dichroic solution.

Der. Obtained as a by-product in the manufacture of alizarine and several other dyes.

G. Technical, crystal or powdered.

- U. P. Chrome alum is in general use as a hardener for photographic emulsions, the addition being made previous to coating. It is also used in the preparation of the chrome alum fixing bath. In process work, chrome alum is used as a hardening agent for gelatine and fish glue, and is used as an addition to the nitric acid bath for etching enamel images on zinc with a view to preventing the image from becoming soft.

### ALUM, IRON, AMMONIA, $\text{FeNH}_4(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$

Fr. Alun de fer. Ger. Ammoniak-eisenalaun

Syn. Ammonio-ferric-sulphate, Iron ammonia sulphate.

M. W. 962.

Sol. in water; Ins. in alcohol.

P. Lilac or violet efflorescent crystals.

Der. Solutions of ferric sulphate and ammonium sulphate are mixed, then evaporated and crystallized, purified by recrystallization.

G. U.S.P.

- U. P. Has been recommended for use in fixing baths, but is not satisfactory. Principal use in photography is in the making of ferric oxalate.

### ALUM POTASH, $\text{Al}_2(\text{SO}_4)_3 \cdot \text{K}_2\text{SO}_4 \cdot 24\text{H}_2\text{O}$

Fr. Alun de Potasse. Ger. Kalialaun

Syn. Aluminum and potassium sulphate.

M. W. 948: Sp. G. 1.7571: M. P.  $105^\circ \text{C}$ .

Sol. in water; Ins. in alcohol.

P. White crystals.

Der. By roasting alunite in special furnaces, afterwards leaching the mass and recovering the salt by crystallization.

G. U.S.P.

- U. P. Used in the preparation of hardening solutions for fixing baths. One of the ingredients of the hypo alum toning bath. Can be used as a clearing bath. In process work used in conjunction with dilute nitric acid for matting surface of zinc plates previous to coating with bichromated albumen. Is sometimes used for hardening photographic emulsions, but is not so suitable as chrome alum.



**ALUMINUM, Al**

Fr. and Ger. Aluminium

M. W. 27: Sp. G. 2.708: M. P. 657° C.

Sol. in acids and alkalies; Ins. in water.

P. Silvery ductile metal.

Der. Obtained by electrolysis of the oxide in a bath of molten cryolite.

G. Sheet and dust.

U. P. Frequently used as one of the ingredients in flash-light powders. Very largely used for the construction of light hand cameras and for lens fittings. Used for the screen and plate-holders of process cameras, as it is not easily acted upon by silver nitrate solutions. Aluminum is now used as a substitute for the lithographic stone.

**ALUMINUM CHLORIDE,  $\text{Al}_2\text{Cl}_6 \cdot 12\text{H}_2\text{O}$** 

Fr. Chlorure d'Alumine. Ger. Chloraluminium

M. W. 483: M. P. 190° C.

Sol. in water, ether and alcohol.

P. Yellowish white crystalline or granular powder, very deliquescent.

Der. Chlorine gas is passed over alumina in a heated tower, the product being recovered by sublimation.

G. Technical (must be kept in well stoppered bottles).

U. P. Used in the gold and platinum toning baths. Has been recommended for hardening gelatine emulsions, but is not satisfactory.

**ALUMINUM SULPHATE,  $\text{Al}_2(\text{SO}_4)_3 \cdot 18\text{H}_2\text{O}$** 

Fr. Sulfate d'Alumine. Ger. Aluminiumsulfat

Of very little importance in photography. This material is often erroneously called alum.

**ALUMINUM SULPHOCYANIDE, Al (CNS)<sub>3</sub>**

Fr. Sulfocyanure d'Alumine. Ger. Aluminum-rhodanid

Syn. Aluminum sulphocyanate, aluminum-rhodanide.

M. W. 402.

Sol. in water; Ins. in alcohol and ether.

P. Yellowish powder, extremely deliquescent.

Der. Aluminum cyanide is boiled with sulphur, the product being purified by crystallization.

G. C.P. (must be kept in well stoppered bottles).

U. P. Used as a preliminary bath for self-toning papers. Has been recommended in connection with gold toning bath, but is unsatisfactory.

**AMMONIA WATER, NH<sub>4</sub>OH**

Fr. Ammonique. Ger. Ammoniakwasser

Syn. Ammonium hydrate, ammonium hydroxide.

Sp. G. (28%) .897: B. P. 38.5° C.

Sol. in water.

P. Colorless liquid with extremely irritating fumes. Should be kept in a cold place in well stoppered bottles.

Der. Gas liquor from coke and gas manufacture is distilled, the volatile salts and ammonia being absorbed in sulphuric acid. This yields ammonium sulphate, which is heated, the ammonia distilled off and collected in water. Also made from waste animal matter.

G. U.S.P. 28%.

U. P. Used as an accelerator in pyro developer. Also for blackening the mercury bleached image in intensification. Is used as an addition to the bichromate bath for sensitizing carbon tissue. Ammonia is used in emulsion making in the ammonia nitrate process in order to produce exceedingly rapid emulsions. In process work is used as an addition to the bichromated albumen solution and also the fish glue solutions.

**AMMONIUM BICHROMATE**  $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$ 

Fr. Bichromate d'Ammoniaque. Ger. Ammoniumdichromat

M. W. 252: Sp. G. 2.153.

Sol. in water and alcohol.

P. Yellow needles, explodes when in contact with many substances.

Der. Chromic acid acting on ammonium hydroxide followed by crystallization.

G. C.P.

U. P. Sometimes used for sensitizing carbon tissue, Gum bichromate, and in various photo-mechanical processes. Has greater sensitizing power than the potassium salt and in the carbon processes gives stronger pictures. In process work is used as a sensitizer for fish glue for printing half-tone images on copper and zinc. Ammonium bichromate is about twice as sensitive to light as is potassium bichromate.

**AMMONIUM BROMIDE**,  $\text{NH}_4\text{Br}$ .

Fr. Bromure d'Ammonium. Ger. Bromammonium

M. W. 98: Sp. G. 2.327.

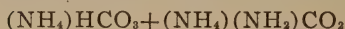
Sol. in water, alcohol and ether.

P. Colorless crystals.

Der. Hydrobromic acid acting on ammonium hydroxide followed by crystallization.

G. U.S.P. granular.

U. P. Can be used as a restrainer in place of the potassium salt, but must not be used with the caustic alkalies or carbonates, as ammonia would be set free. Largely used in emulsion-making, producing an emulsion with a little higher contrast than one made with potassium salt.

**AMMONIUM CARBONATE,**

Fr. Carbonate d'Ammoniaque. Ger. Ammoniumkarbonat

Syn. Hartshörn, rock ammonia.

M. W. 157: M. P. 85° C.

Sol. in water; decomposes in hot water.

P. Colorless crystal plates, unstable in air, rapidly becoming converted to the bicarbonate.

Der. Ammonium hydroxide heated with ammonium bicarbonate.

G. U.S.P. (cubes or powder).

U. P. Can be used to replace ammonia water in some developing solutions, but must not be dissolved in hot water. Is frequently used to replace ammonia in the ammonia processes of emulsion making.

**AMMONIUM CHLORIDE,  $\text{NH}_4\text{Cl}$** 

Fr. Chlorure d'Ammoniaque. Ger. Chlorammonium

Syn. Sal ammoniac.

M. W. 53.5: Sp. G. 1.520.

Sol. in water, alcohol and ammonium hydroxide.

P. White crystals.

Der. Ammonia salts acting on hydrochloric acid followed by crystallization.

G. U.S.P. granular.

U. P. Used in the salting of albumenized paper, its principal use, however, being in the preparation of chloride emulsions.

**AMMONIUM CITRATE,  $(\text{NH}_4)_3\text{C}_6\text{H}_5\text{O}_7$** 

Fr. Citrate d'Ammoniaque. Ger. Ammoniumcitrate

Very little used in photography. Occasionally used as restrainer with pyro developer.

**AMMONIUM FLUORIDE,  $\text{NH}_4\text{F}$** 

Fr. Fluorure d'Ammonium. Ger. Fluorammon

Very little used in photography, occasionally used for stripping negatives. Must be kept in wax-lined bottles.

**AMMONIUM HYPOSULPHITE,  $(\text{NH}_4)_2\text{S}_2\text{O}_3$** 

Fr. Hyposulphite d'Ammoniaque. Ger. Ammonthiosulfat

Syn. Ammonium thiosulphate.

Very little used in photography. In the earlier days was recommended as a substitute for the sodium salt.

**AMMONIUM IODIDE,  $\text{NH}_4\text{I}$** 

Fr. Iodure d'Ammonium. Ger. Iodammon

M. W. 145: Sp. G. 2,501.

Sol. in water and alcohol.

P. White crystals.

Der. Action of ammonium hydroxide on hydroiodic acid, followed by crystallization.

G. U.S.P. granular.

U. P. Is used in making iodized collodion and has been recommended for negative emulsions. It is unsatisfactory for fast gelatino-bromide emulsions because it is unstable and readily gives off iodine.

**AMMONIUM MOLYBDATE,  $(\text{NH}_4)_6\text{Mo}_7\text{O}_{24}4\text{H}_2\text{O}$** 

Fr. Molybdate d'Ammoniaque. Ger. Molybdansaures Ammonium

M. W. 1236: Sp. G. 2.38-2.95.

Sol. in water and acids.

P. White crystalline powder readily decomposed by heat.

Der. By the reaction of a solution of molybdic acid and ammonium hydroxide followed by crystallization.

G. U.S.P. crystals.

U. P. Used as an ingredient in P. O. P. emulsions to give greater contrast; has also been recommended as an addition to chloride and bromide emulsions to increase contrast and blacks.



**AMMONIUM NITRATE,  $\text{NH}_4\text{NO}_3$** 

Fr. Azotate d'Ammonium. Ger. Salpetersaures Ammon

M. W. 80; Sp. G. 1.725; M. P. 153. Decomposes at  $210^\circ \text{C}$ .  
Sol. in water, alcohol and alkalies.

P. Colorless crystals, explosive.

Der. By the action of ammonium hydroxide on nitric acid.

G. U.S.P. granular.

U. P. Sometimes used as a substitute for the potassium salt in flash-light mixtures; is one of the salts formed in emulsion-making by the double decomposition of ammonium bromide and silver nitrate.

**AMMONIUM OXALATE,  $(\text{NH}_4)_2\text{C}_2\text{O}_4\cdot\text{H}_2\text{O}$** 

Fr. Oxalate d'Ammoniaque. Ger. Ammonoxalat

Very little used in photography; finds occasional use in the preparation of ferric ammonio-oxalate.

**AMMONIUM PERSULPHATE,  $(\text{NH}_4)_2\text{S}_2\text{O}_8$** 

Fr. Persulfate d'Ammoniaque. Ger. Ueberschwefelsaures Ammonium

M. W. 228.

Sol. in water.

P. White crystals.

Der. By the electrolysis of a concentrated solution of ammonium sulphate followed by crystallization.

G. C. P. crystals.

U. P. Its principal use is as a reducer, its valuable property being that it reduces the high-light detail more than the shadows. Has been suggested as a hypo eliminator. Sometimes used to remove developer stains and as an addition to the oxalate developer for platinotypes. Such an addition improves the quality of over-exposed platinotype prints.

**AMMONIUM PHOSPHATE**  $(\text{NH}_4)_2\text{HPO}_4$ 

Fr. Phosphate d'Ammonium. Ger. Ammon-phosphat

Syn. Ammonium diphosphate, Diammonium ortho-phosphate.

M. W. 132: Sp. G. 1.619.

Sol. in water; Ins. in alcohol.

P. White crystals.

Der. Reaction of ammonium hydroxide and phosphoric acid, followed by crystallization.

G. C. P. granular.

U. P. Frequently used for fire-proofing fabrics for use around the studio and work-rooms, and used in making the slow silver phosphate emulsions.

**AMMONIUM SULPHOCYANIDE**,  $\text{NH}_4\text{CNS}$ 

Fr. Sulfocyanure d'Ammonium. Ger. Rhodanammonium.

Syn. Ammonium sulphocyanate, Thiocyanate or rhodanide of ammonia.

M. W. 76: Sp. G. 1.3057: M. P.  $159^\circ \text{C}$ .

Sol. in water and alcohol.

P. Colorless, deliquescent crystals. Must be kept well stoppered.

Der. By boiling an aqueous solution of ammonium cyanide with sulphur or polysulphides.

G. Pure.

U. P. Its principal use is in the gold toning bath for printing-out papers. A 5% solution will dissolve gelatine in the cold, and has therefore found some use in the development of over-exposed carbon prints.

**AMMONIUM SULPHYDRATE**,  $\text{NH}_4\text{HS}$ 

Fr. Sulphydrate d'Ammoniaque. Ger. Schwefelammon.

Syn. Ammonium hydrosulphide, Ammonium sulphide.

M. W. 51: M. P. Decomposes.

Sol. in water and alcohol.

P. Colorless crystalline mass, rapidly turning yellow on exposure to air.

Der. By passing sulphuretted hydrogen into liquor ammonia.

G. Pure.

U. P. Used for blackening wet collodion negatives after intensification with lead nitrate, copper bromide, or silver iodide.

**AMMONIUM THIOMOLYBDATE,  $(\text{NH}_4)_2\text{MoS}_4$** 

Fr. Sulfomolybdate d'Ammonium. Ger. Ammoniak  
Thiomolybdat.

M. W. 260.

Sol. in water; Ins. in alcohol.

P. Red scales.

Der. By boiling molybdenum trisulphide in ammonium sulphide.

G. Pure.

U. P. Used in sulphiding bromide prints in place of sodium sulphide.

**AMMONIUM VANADATE,  $\text{NH}_4\text{VO}_3$** 

Fr. Vanadate d'Ammoniaque. Ger. Vanadinsäures  
Ammoniak.

Syn. Ammonium metavanadate.

M. W. 116.

Ss. in water.

P. Colorless crystals.

G. Pure.

U. P. Has been used as an addition to printing-out emulsions to increase contrast.

**AMYL ACETATE,  $\text{C}_5\text{H}_{11}\text{C}_2\text{H}_3\text{O}_2$** 

Fr. Acétate d'Amyle. Ger. Amylacetat, Birnenöl.

Syn. Essence of jargonelle pears, Amylacetate ester, Isoamylacetate.

M. W. 130: Sp. G. 0.8659: B. P. 148° C.

Sol. Very slightly soluble in water; Ins. in alcohol.

P. Colorless liquid, banana-like odor.

Der. By adding sulphuric acid to a mixture of amyl alcohol and acetic acid with subsequent recovery by distillation.

G. U.S.P.

U. P. Is used as one of the solvents in the making of celluloid for photographic film. When used to dissolve scrap celluloid, yields a hard varnish which can be applied cold to negatives. It has also been used in the Heßner-Altenack lamp which was adopted by the International Congress of Photography in 1889 as a standard light in sensitometry.

**ANTIMONY SULPHIDE,  $\text{Sb}_2\text{S}_3$** 

Fr. Sulfure d'Antimoine. Ger. Schwefelantimon.

Syn. Antimonous sulphide, Black antimony.

M. W. 336: Sp. G. 4.562: M. P.  $546^\circ \text{C}$ .

Sol. in Ammonium sulphide, Potassium sulphide and Hydrochloric acid; Ins. in water.

P. Black crystals or Orange-red crystals; poisonous.

Der. Occurs in nature as the black crystalline stibnite. As precipitated from solutions of salts of antimony, the trisulphide is an orange-red precipitate, which is filtered, dried and ground.

G. Technical.

U. P. Occasionally used in conjunction with magnesium powder for flashlight work, but as the products of combustion are poisonous, it is not to be recommended.

**BARIUM BROMIDE,  $\text{BaBr}_2 \cdot 2\text{H}_2\text{O}$** 

Fr. Bromure de Baryum. Ger. Baryumbromid.

M. W. 333: Sp. G. 3.852.

Sol. in water.

P. Colorless crystals; poisonous.

Der. By the interaction of barium sulphide and hydrobromic acid, with subsequent crystallization.

G. Technical.

U. P. Sometimes used in the preparation of collodion emulsions, and has been recommended in connection with silver bromide emulsions as a means of increasing contrast.

**BARIUM CHLORIDE,  $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$** 

Fr. Chlorure de Baryum. Ger. Baryumchlorid.

M. W. 244: Sp. G. 3.097: M. P.  $860^\circ \text{C}$ .

Sol. in water; Ins. in alcohol.

P. Colorless flat crystals; poisonous.

Der. By the action of hydrochloric acid on barium sulphide with subsequent crystallization.

G. U.S.P.

- U. P. Occasionally used in emulsion making, both collodion and silver bromide. Its principal use, however, is in the preparation of barium sulphate by reaction with sodium sulphate.

### BARIUM IODIDE, $\text{BaI}_2\cdot 2\text{H}_2\text{O}$

Fr. Iodure de Baryum. Ger. Iodbaryum.

M. W. 427: Sp. G. 5.150: M. P. Loses  $2\text{H}_2\text{O}$  at  $539^\circ \text{C}$ . and melts at  $740^\circ \text{C}$ .

Sol. in water and alcohol.

P. Colorless crystals; decomposing and reddening on exposure to air; poisonous.

Der. By the action of hydriodic acid on barium hydroxide.

G. Technical.

U. P. Frequently used in making collodion emulsions; increases contrast.

### BARIUM SULPHATE, $\text{BaSO}_4$

Fr. Sulfate de Baryum. Ger. Schwefelsaures Baryt, Schwerspat.

Syn. Barytes, Synthetic barytes, Blanc fixe, Permanent white, Baryta white, Mountain snow.

M. W. 233: Sp. G. 4.476.

Sol. in concentrated sulphuric acid; Ins. in water.

P. Heavy white impalpable powder; poisonous.

Der. By the action of sulphuric acid or sodium sulphate on solutions of barium salts followed by careful drying and grinding.

G. Technical photographic.

U. P. Principle use is in coating photographic paper to produce a smooth, white, inert surface, upon which to coat the sensitive emulsions. The barium sulphate coating also insulates the paper stock, and prevents any reaction between the organic material of the paper and the emulsion which might result in decomposition and fog. According to the surface required, various crystalline forms of barium sulphate are used, the two most common being: glossy and matte blanc fixe. Barium sulphate is also added to emulsions in order to produce a semi-matte surface.



**BENZOL (Benzene),  $C_6H_6$** 

Fr. Benzol, Benzine Crystallisable. Ger. Benzol, Steinkohlenbenzin.

Syn. Benzol or Benzole, Coal tar naphtha, Phenyl hydride.

M. W. 78: Sp. G. 0.87843: M. P.  $5.483^{\circ} C.$ : B. P.  $79.7^{\circ} C.$

Sol. in alcohol and ether; Ins. in water.

P. Clear, colorless, inflammable liquid; characteristic odor. Solidifies at  $0^{\circ} C.$

Der. (a) Illuminating gas and coke-oven gas are "scrubbed," by passing through oil which thus becomes saturated with benzol and toluol. The resulting oil is distilled, benzol and toluol being recovered, which are then separated by fractional distillation. (b) Coal-tar, after dehydration is fractionally distilled, yielding "light oil." On distilling this the first runnings contain the crude benzol.

G. U.S.P.

U. P. Benzol is used in the preparation of a number of photographic varnishes, particularly matt varnish. In process work benzol is largely used for dissolving India rubber to make the edging solution for wet collodion negatives, and also for coating wet plates as a preliminary to applying collodion for stripping. It is an excellent solvent for asphaltum, and is also used as a solvent in the preparation of encaustic paste. Benzol must not be confused with *benzine* which is practically identical with gasoline.

**CADMIUM-AMMONIUM BROMIDE,**

Fr. Bromure double de Cadmium et d'Ammonium.

Ger. Zweifach-Ammonium-Cadmiumbromid.

M. W. 758.

Sol. in water and alcohol, and in equal parts of alcohol and ether.

Der. Prepared by dissolving crystallized cadmium bromide and ammonium bromide in water, and then crystallizing.

U. P. This double salt has found considerable use in collodion processes on account of its greater stability. It considerably increases the sensitiveness of the collodion emulsion.

**CADMIUM-AMMONIUM IODIDE,  $\text{CdI}_2 \cdot 2\text{NH}_4 \cdot 12\text{H}_2\text{O}$** 

Fr. Iodure double de Cadmium et d'Ammonium.

Ger. Zweifach-Ammonium-Cadmiumiodid.

M. W. 692.

Sol. in water and alcohol, and in mixtures of alcohol and ether.

Der. Prepared by dissolving ammonium iodide and cadmium iodide in water and then crystallizing.

U. P. Used in collodion emulsion, giving considerably more sensitiveness than the single salts.

**CADMIUM BROMIDE,  $\text{CdBr}_2 \cdot 4\text{H}_2\text{O}$** 

Fr. Bromure de Cadmium. Ger. Bromcadmium.

M. W. 344: Sp. G. 5.192: M. P.  $568^\circ \text{C}$ .: B. P.  $806^\circ\text{--}812^\circ \text{C}$ .

Sol. in water and alcohol; Ss. in ether.

P. Yellowish crystalline powder.

Der. By heating cadmium to redness in bromine vapor.

G. Technical photographic.

U. P. Used in bromising collodion.

**CADMIUM CHLORIDE,  $\text{CdCl}_2 \cdot 2\text{H}_2\text{O}$** 

Fr. Chlorure de Cadmium. Ger. Chlorcadmium.

M. W. 201: Sp. G. 3.327: M. P.  $568^\circ \text{C}$ .: B. P.  $861^\circ\text{--}954^\circ \text{C}$ .

Sol. in water and alcohol.

P. Small white crystals

Der. By the action of hydrochloric acid on cadmium with subsequent crystallization.

G. Technical photographic.

U. P. Sometimes used in collodion emulsions.

**CADMIUM IODIDE**  $\text{CdI}_2$ 

Fr. Iodure de Cadmium. Ger. Iodcadmium.

M. W. 366; Sp. G. 5.644; M. P.  $385^\circ \text{C}$ .; B. P.  $708^\circ\text{-}719^\circ \text{C}$ .

Sol. in water, alcohol and ether.

P. Colorless, flaky crystals.

Der. By the action of hydriodic acid on cadmium oxide and crystallization.

G. Technical photographic.

U. P. The best salt for iodizing collodion for process negatives, used in conjunction with ammonium iodide.

**CALCIUM BROMIDE**,  $\text{CaBr}_2$ 

Fr. Bromure de Calcium. Ger. Bromcalcium.

M. W. 200; Sp. G. 3.353; M. P.  $680^\circ\text{-}760^\circ \text{C}$ .; B. P.  $806^\circ\text{-}812^\circ \text{C}$ .

Sol. in water.

P. White, granular, very deliquescent crystals; sharp, saline taste. Should be kept well stoppered.

Der. By the action of hydrobromic acid on calcium oxide, carbonate or hydroxide and subsequent crystallization.

G. U.S.P.

U. P. Used in making collodion emulsion.

**CALCIUM CARBONATE (Chalk)**,  $\text{CaCO}_3$ 

Fr. Carbonate de Chaux. Ger. Kreide, Kohlensaures Kalk.

M. W. 100; Sp. G. 2.72-2.95.

Sol. in acids; Ins. in water.

P. White amorphous powder or colorless crystals.

Der. By adding a soluble carbonate to a calcium salt solution.

G. U.S.P.

U. P. Used in neutralizing gold toning baths.

**CALCIUM CHLORIDE (Crystals),  $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$** 

Fr. Chlorure de Calcium. Ger. Chlorcalcium.

M. W. 219: Sp. G. 1.654.

Sol. in water and alcohol.

P. White deliquescent crystals. Must be kept well stoppered.

Der. Commercially obtained as a by-product in the Solvay soda process and in the manufacture of potassium chlorate.

G. U.S.P.

U. P. Used occasionally in emulsion making. The commercial dry chloride ( $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$ ) is used as a desiccating agent for platinotype and other papers. In process work is a constituent of the iodizer for collodion. Small circles of filter or blotting paper saturated with a solution of calcium chloride are placed in the tin cans in which film is packed for the tropics.

**CAMPHOR,  $\text{C}_{10}\text{H}_{16}\text{O}$** 

Fr. Camphre. Ger. Kampfer.

Syn. Formosa camphor, Japan camphor.

M. W. 152: Sp. G. 0.986-0.996: M. P.  $175^\circ \text{C}$ .: B. P.  $204^\circ \text{C}$ .

Sol. in alcohol, ether, chloroform and carbon bisulphide.

P. White, translucent masses, easily broken.

Der. From the wood of the camphor laurel tree.

G. Technical; U.S.P.

U. P. Camphor is used in the manufacture of a number of photographic varnishes and retouching mediums. It is one of the most important constituents of celluloid, having a marked influence on the physical properties of the finished material. In celluloid manufacture, camphor functions as a latent solvent, and has an influence on the life of the sheet and its flexibility. A number of substitutes for camphor have been suggested but none of them are quite as satisfactory as the genuine material.

**CARBON DISULPHIDE, CS<sub>2</sub>**

Fr. Sulfure de Carbone. Ger. Schwefelkohlenstoff.

Syn. Carbon bisulphide.

M. W. 76: Sp. G. 1.2927: M. P.—111.6° C.: B. P. 46.25° C.

Sol. in alcohol and ether; Ss. in water.

P. Clear, colorless, inflammable liquid. Care must be used in handling as the vapor when mixed with air forms an explosive compound; poisonous.

Der. By the action of sulphur vapors on red-hot carbon, the vapors formed being condensed, or by heating sulphur and carbon in an electric furnace and condensing the carbon bisulphide vapors.

G. Technical.

U. P. Used in the preparation of various cold varnishes, as it is a good solvent of amber and other resins. Also used as a solvent for India rubber in making rubber solutions.

**CARBON TETRACHLORIDE, CCl<sub>4</sub>**

Syn. Tetrachloromethane.

M. W. 156: Sp. G. 1.5835: M. P.—22.95° C.: B. P. 76.74° C.

Sol. in alcohol and ether; Ss. in water.

P. Light, colorless liquid, peculiar odor, yielding heavy vapors; non-inflammable; poisonous.

Der. By the interaction of carbon bisulphide and chlorine in presence of a catalyzer.

G. Technical.

U. P. Is an excellent solvent of shellac, asphalt, and fats. Is valuable as a cleaning fluid, as it has no action on metals, colors or fabrics.



**CELLULOID**

Fr. Celluloïde. Ger. Celluloid.

- Sol. in alcohol and ether, and various mixtures of amyl-acetate, acetone, fusel oil, etc.; Ins. in water.
- Der. By mixing nitrated cellulose, camphor and other ingredients in suitable solvents, producing what is known as "dope." This is a viscous solution which is flowed upon a casting wheel and upon the evaporation of the solvents, sheet celluloid is obtained. It is produced in long rolls of suitable width, and in varying thicknesses, according to the purpose for which it is intended. Highly inflammable.
- U. P. Sheet celluloid is the most important flexible emulsion support used in the production of modern roll film and motion picture film. In connection with roll film a suitable coating is applied on the side opposite to that on which the emulsion is coated to counteract the natural curl, producing the so-called non-curling roll film. For motion picture work, sheet celluloid is now produced in a number of different colors, to largely do away with tinting and toning.

**CELLULOSE ACETATE,  $C_6H_5(CO_2CH_3)_5$** 

Fr. Cellulose Acétate. Ger. Celluloseacetat.

- Syn. Sericose.
- Sol. in alcohol; Ins. in water.
- P. Yellowish, transparent amorphous mass. Non-inflammable.
- Der. By the acetylation of cellulose in the presence of sulphuric acid.
- G. Special photographic.
- U. P. Cellulose Acetate is the basis of the modern non-inflammable photographic and motion picture film. A number of forms of this material are known, their properties varying according to the process of manufacture. Cellulose acetate may be obtained insoluble in alcohol, soluble in chloroform, etc.

**CERIC SULPHATE,  $\text{Ce}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$** 

Fr. Sulfate de Cérium. Sulfate Cérique. Ger. Cerisulfat.

Syn. Sulphate of cerium.

M. W. 404.

Sol. in water.

P. Reddish-yellow crystals.

Der. By the action of sulphuric acid on cerium carbonate.

G. Technical.

U. P. Is used as a photographic reducer, a 5% solution acting more strongly on the high-lights of a negative than the shadows. Is also used for sensitizing paper in the cerium printing processes, capable of producing prints in a great variety of colors according to the organic substances with which the prints are treated.

**CHLORAL HYDRATE,  $\text{CCl}_3 + \text{CH}(\text{OH})_2$** 

Fr. Chloral Hydrate. Ger. Chloral Hydrat.

Syn. Trichloradelhyde.

M. W. 165.5: Sp. G. 1.901: M. P.  $57^\circ \text{C}$ : B. P.  $97.5^\circ \text{C}$ .

Sol. in water, alcohol and ether.

P. Transparent, colorless crystals; poisonous.

Der. By the action of  $\frac{1}{5}$  of its volume of water on chloral.

G. U.S.P.

U. P. Is sometimes used as a solvent of gelatine in the manufacture of photographic mountants, and has been used in the preparation of non-inflammable film.

**CHLOROFORM,  $\text{CHCl}_3$** 

Fr. Chloroforme. Ger. Chloroform.

Syn. Trichloromethane, Methenyl trichloride.

M. W. 119.5: Sp. G. 1.49887: M. P.— $63.2^\circ \text{C}$ : B. P.  $61.20^\circ \text{C}$ .

Sol. in alcohol and ether; Ss. in water.

P. Clear, colorless, highly refractive, volatile liquid; characteristic odor; non-inflammable.

Der. By the reaction of calcium oxychloride with acetone and distillation.

G. U.S.P.

U. P. Is a solvent of amber, resins, and is useful in the preparation of a number of varnishes. It is also a good solvent for iodine, bromine, camphor, and some forms of cellulose acetate. Should be kept in the dark.

**COBALT CHLORIDE,  $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$** 

Fr. Chlorure de Cobalt. Ger. Kobaltchlorid.

Syn. Cobaltous Chloride.

M. W. 238: Sp. G. 1.84: M. P.  $86.75^\circ \text{C}$ .

Sol. in water and alcohol.

P. Ruby-red crystals.

Der. By the action of hydrochloric acid on cobalt oxide with subsequent crystallization.

G. Technical.

U. P. The addition of a small amount of cobalt chloride to printing-out emulsions increases contrast. Is one of the constituents of the cobalt-lead toning bath giving a green image on bromide and gaslight papers.

**COPPER BROMIDE,  $\text{CuBr}_2$** 

Fr. Bromure de Cuivre. Ger. Kupferbromid.

Syn. Cupric bromide.

M. W. 223.5.

Sol. in water; Ss. in alcohol.

P. Greyish black crystalline powder.

Der. Most easily prepared by double decomposition using solutions of copper sulphate and potassium bromide.

G. C. P.

U. P. Has been used for the intensification of negatives, and for bleaching bromide prints previous to sulphide toning. In process work the copper bromide intensifier is employed for half-tone negatives, and has a marked cutting action which tends to sharpen up the dots. Still greater density can be obtained by flowing over a solution of either sodium or ammonium sulphide.

**COPPER CHLORIDE,  $\text{CuCl}_2 + 2\text{H}_2\text{O}$** 

Fr. Chlorure de Cuivre. Ger. Kupferchlorid.

Syn. Cupric chloride, Copper bi- or di-chloride.

M. W. 170.5: Sp. G. 2.47.

Sol. in water, alcohol and ether.

P. Greenish-blue, deliquescent crystals; poisonous. Must be kept well stoppered.

Der. Copper carbonate is dissociated with hydrochloric acid and the product is crystallized.

G. Pure crystals.

U. P. Is occasionally used as a reducer according to Spiller's formula. Added to printing-out emulsions it increases contrast. Is also used in Obernetter's photogravure process. A small amount of a 1% solution of copper chloride added to silver bromide emulsion reduces the speed and increases contrast.

**COPPER SULPHATE,  $\text{CuSO}_4 + 5\text{H}_2\text{O}$** 

Fr. Sulfate de Cuivre. Ger. Kupfersulfat.

Syn. Cupric sulphate, Blue vitriol.

M. W. 249.5: Sp. G. 2.284.

Sol. in water and alcohol.

P. Blue crystals, slowly efflorescing in air; almost white when dehydrated; poisonous. Should be kept well stoppered.

Der. By the action of sulphuric acid on copper or copper oxide in large quantities, with evaporation and crystallization.

G. U.S.P.

U. P. With an excess of liquor ammonia gives a blue solution which forms a useful filter for color sensitometry and three color work. Is one of the constituents of the bromo-iodide of copper intensifying solution, and is used in copper toning baths producing various tones from warm black to red chalk upon bromide prints. In process work is used as an addition to the wet plate developer, its function being to retard the oxidation of the ferrous sulphate; in electrotyping it is used with sulphuric acid to form the depositing solution.

**ETHER,  $C_2H_5OC_2H_5$** 

Fr. Ether Sulfurique. Ger. Aether.

Syn. Ethyl oxide, Ethylic ether, Sulphuric ether.

M. W. 74: Sp. G. 0.71994: M. P.—116.2° C.: B. P. 34.97° C.

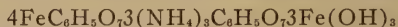
Sol. in water and alcohol.

P. Very light, transparent, colorless, volatile, exceedingly inflammable, mobile liquid; pleasant aromatic odor. Note: Have no flames or sparking electrical equipment present when ether is being used. Should be kept well stoppered in a cool place.

Der. By the action of sulphuric acid on ethyl alcohol, followed by distillation.

G. U.S.P.

U. P. Used in the preparation of collodion and varnishes, also for washing bitumen to increase its sensitiveness, and with alcohol as a solvent for bitumen in a process for graining the plate by reticulation. Is a solvent for certain forms of cellulose acetate. Is also a solvent of iodine, bromine, sulphur, phosphorus, many essential oils, corrosive sublimate and other salts.

**FERRIC AMMONIO-CITRATE (Brown),**

Fr. Citrate de fer Ammoniacale. Ger. Braune Citronensäure Eisenoxydammoniak.

Syn. Ammonium citrate of iron.

M. W. 2030.

Sol. in water; Ins. in alcohol.

P. Reddish-brown, transparent, hygroscopic crystalline scales; saline taste; deliquescent in moist air. Should be kept well stoppered and in the dark.

Der. By the addition of citric acid to ferric hydroxide, then adding ammonium hydroxide, followed by filtration.

G. U.S.P.

U. P. Used in conjunction with potassium ferricyanide in the iron printing processes. There is also a green salt which gives more sensitive papers with cleaner whites than the brown salt.



**FERRIC AMMONIO-OXALATE,**

Fr. Oxalate Ammoniaco-Ferrique. Ger. Ammonium Ferrioxalat.

Syn. Ammonium oxalate of iron, Oxalate of iron and ammonia.

M. W. 892.

Sol. in water.

P. Green crystals.

Der. By the interaction of ammonium binoxalate and ferric hydroxide.

G. Technical.

U. P. Sometimes used in the preparation of blue prints. Also used in the cold development of platinum and print-out platinum processes.

**FERRIC AMMONIO-SULPHATE,**

Fr. Sulfate de fer Ammoniacale. Ger. Schwefelsäure. Eisenoxydammoniak.

Syn. Ammonium sulphate of iron.

M. W. 328.

Sol. in water; Ins. in alcohol.

P. Pale greenish crystals.

Der. By mixing solutions of ferric sulphate and ammonium sulphate, followed by evaporation and crystallization.

G. C. P.

U. P. Is occasionally used as a substitute for ferrous sulphate on account of its greater stability, and has been used in the developing of wet plates.

**FERRIC CHLORIDE (Lump),  $\text{FeCl}_3\cdot 6\text{H}_2\text{O}$** 

Fr. Chlorure Ferrique. Ger. Eisenchlorid.

Syn. Perchloride or sesquichloride of iron, Iron trichloride.

M. W. 270.5: M. P.  $37^\circ \text{C}$ .

Sol. in water, alcohol and ether.

P. Very deliquescent, orange-yellow, crystals (lumps).

Der. By passing chlorine into a solution of ferrous chloride.

G. U.S.P.

U. P. Is sometimes used as a reducer for negatives, but is not to be recommended as it is likely to produce yellow stains, due to formation of basic ferrous salts. In process work is used as a mordant in photogravure and half-tone plates.

**FERRIC OXALATE,  $\text{Fe}_2(\text{C}_2\text{O}_4)_3$** 

Fr. Oxalate Ferrique. Ger. Ferrioxalat.

Syn. Iron sesquioxalate.

M. W. 376.

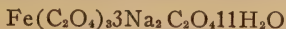
Sol. in water; Ins. in alcohol.

P. Greenish glistening scales. Extremely sensitive to light.

Der. A solution of ammonia-iron-alum and liquor ammonia mixed together and allowed to stand until the precipitated ferric hydrate has settled, then pure oxalic acid is added and the mixture allowed to stand in the dark until the precipitate is completely dissolved.

G. Technical.

U. P. Used in the Kallitype process, its chief use, however, is as the sensitive salt in the platinotype process.

**FERRIC SODIUM OXALATE,**

- Fr. Oxalate de fer et de Soude. Ger. Natriumferrioxalat.  
Syn. Sodio-ferric oxalate.  
M. W. 976.  
Sol. in water; Ins. in alcohol.  
P. Emerald-green crystals.  
Der. By the interaction of sodium acid oxalate and ferric hydroxide.  
G. Technical photographic.  
U. P. Used in the preparation of printing-out platinum papers.

**FERRIC SULPHATE,  $\text{Fe}_2(\text{SO}_4)_3 \cdot 9\text{H}_2\text{O}$** 

- Fr. Sulfate Ferrique. Ger. Ferrisulfat, Schwefelsäure. Eisenoxyd.  
Syn. Sesqui-sulphate of iron.  
M. W. 563; Sp. G. 2-2.1; M. P. Decomposes.  
Sol. in water.  
P. Greenish crystals.  
Der. By adding sulphuric acid to a solution of ferrous sulphate.  
G. U.S.P.  
U. P. Has been suggested as a reducer, but is very likely to give yellow stains, due to the formation of basic iron salts in the film.

**FERROUS NITRATE,  $\text{Fe}(\text{NO}_3)_2 \cdot 12\text{H}_2\text{O}$** 

- Fr. Azotate Ferreux. Ger. Salpetersaure Eisenoxydul.  
Syn. Protonitrate of iron.  
M. W. 536.  
Sol. in water and in dilute alcohol.  
P. Greenish-white crystals.  
Der. Prepared by mixing ferrous sulphate with barium nitrate in solution.  
U. P. Used in wet collodion process, gives an image much whiter in color than ferrous sulphate.

**FERROUS POTASSIUM OXALATE,**

Fr. Oxalate de Potassium Ferreux. Ger. Kalium-Eisenoxalat.

Syn. Potassio-ferrous Oxalate.

M. W. 328.

Sol. in water.

Der. Occurs in the ferrous oxalate developer by the mixture of ferrous sulphate and potassium oxalate.

U. P. The ferrous oxalate developer is one of the oldest for plates and bromide papers, and has almost entirely been replaced by the modern organic developers. Its advantage is the production of an image in pure metallic silver, that is to say, without stain. When used for bromide papers, an acid bath after development is necessary in order to prevent the deposition of basic iron salts in the paper. Bromide acts as a restrainer and small quantities of hypo solution acts as an accelerator with this developer. Can also be used as the blackening solution in connection with intensifying with mercuric chloride and allows of repeating the bleaching and blackening processes.

**FERROUS SULPHATE,  $\text{FeSO}_4\cdot 7\text{H}_2\text{O}$** 

Fr. Sulfate de Fer. Ger. Schwefelsaures Eisenoxydul.

Syn. Sulphate or protosulphate of iron, Green copperas, Green Vitriol.

M. W. 278: Sp. G. 1.8987: M. P.  $64^\circ \text{C}$ .

Sol. in water; Ins. in alcohol.

P. Greenish crystals, often rusty in color from oxidation and efflorescence. Before use the rusty powder should be rinsed off.

Der. (a) A by-product from the pickling of steel. (b) By the action of dilute sulphuric acid on iron and with subsequent crystallization.

G. U.S.P.

U. P. Is used as a developer for wet collodion plates, and is one of the ingredients used in the preparation of the ferrous oxalate developer.

**FORMALIN, CH<sub>2</sub>O**

Fr. Formol. Ger. Aldehyde Formique.

Syn. Formaldehyde, Formic aldehyde.

Sp. G. 1.075-1.081.

Sol. in water and alcohol.

P. Clear, colorless liquid. Suffocating odor; poisonous. Is an aqueous solution of formaldehyde gas. The vapors attack the mucous membrane of the eyes, nose and throat, causing intense irritation.

Der. The vapors of methyl alcohol are passed through a heated copper tube and subsequently absorbed in water.

G. U.S.P. 40%.

U. P. Is used as a hardening bath immediately after fixing for both negatives and prints, a suitable strength is 10%. Used in conjunction with the hydroquinone developer yields negatives of great contrast. In emulsion work is used as a hardener; very small amount considerably raises the melting point of gelatine; emulsions hardened with formaldehyde stand warm developing solutions exceptionally well.

**GELATINE**

Fr. Gelatine. Ger. Gallerte, Gelatin.

Sol. in hot water; Ins. in alcohol and ether, also Ins. in cold water but will absorb it and swell up to a slimy mass.

P. Translucent sheets or flakes.

Der. By extraction with water from certain kinds of bones and parts of the skin of cattle, selected, washed and treated with especial care so that the resulting product is cleaner and purer than ordinary glue. The raw stock for photographic gelatines must be carefully chosen, as it has a decided influence on the characteristics and behavior of the finished product.

G. Photographic, Hard, Medium, Soft.

U. P. Gelatine is used in the preparation of baryta coating solutions for photographic paper, in collotype, photo-gravure, and many other photo-mechanical processes. It is the chief ingredient in photographic mountants. Solutions of sulphocyanide and barium chloride dissolve gelatine in the cold, and so do acetic, oxalic, hydrochloric and sulphuric acids. Gelatine is the principle factor in modern emulsion making, acting as the supporting colloid

for silver iodide, bromide or chloride. For emulsion making it is nearly always necessary to use a proper blend or selection of hard and soft gelatines in order to secure the desired photographic quality. In process work gelatine has many uses: in the preparation of photolithographic paper, carbon tissue, gelatine reliefs, substratum on glass plates or films, litho-transfer papers and stripping negative films, also used in making color filters and for glazing prints.

### GLYCERINE, $C_3H_5(OH)_3$

Fr. Glycérine. Ger. Glycerin.

M. W. 92: Sp. G. 1.2604: M. P.  $17^{\circ}$  C. B. P.  $290^{\circ}$  C.

Sol. in water and alcohol; Ins. in ether.

P. Clear, colorless, or pale yellow, odorless, syrupy liquid: sweet, warm taste.

Der. From the spent lye liquor from the saponification of fats and oils in the soap industry, by the precipitation of salt, albuminoids and metallic soaps of the higher fatty acids, by iron persulphate (crude) or aluminum sulphate and concentration with subsequent steam distillation.

G. U.S.P.

U. P. Glycerine is used as a control in developing platinotypes, and is frequently used as an addition to emulsions to insure a smooth coating and to prevent curling. In motion picture work, film is immersed in a glycerine bath to keep it flexible and supple. In collotype, glycerine is used for etching or damping the plate previous to inking.

### GOLD CHLORIDE (Yellow), $AuCl_3$

Fr. Chlorure d'or. Ger. Goldchlorid.

Syn. Trichloride or perchloride of gold, Auric chloride.

M. W. 303.

Sol. in water, alcohol and ether.

P. Yellowish brown crystals. Very hygroscopic, should be kept in solution.

Der. By dissolving gold in aqua regia.

G. Photographic.

U. P. Principal use, in toning baths for gelatino-chloride and collodio-chloride printing-out papers. In some of the so-called self-toning papers gold chloride is added to the emulsion.



**HYDRAZINE,  $\text{NH}_2\text{NH}_2$** 

Fr. Hydrazine. Ger. Hydrazin.

Syn. Diamidogen or Diamine.

M. W. 32: Sp. G. 1.013: M. P.  $1.4^\circ \text{C}$ .: B. P.  $113.5^\circ \text{C}$ .

Sol. in water and alcohol.

P. Colorless liquid.

Der. By reduction of nitrosamine with zinc dust and acetic acid.

G. Special photographic.

U. P. Several hydrazine compounds have been used as additions to emulsions to obtain more contrast, and are said to increase the latitude of an emulsion, making it difficult to over-expose.

**HYDROGEN PEROXIDE,  $\text{H}_2\text{O}_2$** 

Fr. Péroxyde d'Hydrogène, Eau Oxygénée.

Ger. Wasserstoffperoxyd.

Syn. Hydrogen dioxide, Hydroxyl, Perhydrol.

M. W. 34: Sp. G. 1.111.

Sol. in water, alcohol and ether.

P. Colorless, heavy liquid, appearing in commerce in the form of an aqueous solution. Keep cool and dark. A powerful oxidizing agent.

Der. By the action of dilute mineral acid, usually sulphuric on barium peroxide.

G. U.S.P.; 30% by weight.

U. P. Has been suggested as a "hypo" eliminator; when rendered alkaline is a weak developer. The fact that wood, resins, etc., act upon dry plates has been ascribed to the presence of hydrogen peroxide. Recent investigations have shown that hydrogen peroxide can produce upon the photographic emulsion an effect equivalent to light action.

**LEAD ACETATE,  $\text{Pb}(\text{CH}_3\text{COO})_2 \cdot 3\text{H}_2\text{O}$** 

Fr. Acetate de Plomb. Ger. Bleiacetat.

Syn. Sugar of lead, Normal plumbic acetate.

M. W. 379: Sp. G. 2.50: M. P. Loses  $3\text{H}_2\text{O}$  at  $75^\circ \text{C}$ .: B. P.  $280^\circ \text{C}$ .

Sol. in water; Ins. in alcohol.

P. White crystals (Commercial grades are frequently brown or gray lumps); poisonous.

Der. By the action of acetic acid on litharge.

G. U.S.P.

U. P. Used in some forms of combined toning and fixing baths.

**LEAD CHROMATE,  $\text{PbCrO}_4$** 

Fr. Chromate de Plomb. Ger. Chromsaures Blei.

M. W. 323: Sp. G. 6.123: M. P. Decomposes at  $600^\circ \text{C}$ .

Sol. in acids; Ins. in water.

P. Yellow crystals; poisonous.

Der. By interaction of solutions of sodium chromate and lead nitrate.

G. Technical.

U. P. Is used as a pigment, and in the preparation of orange fabric for dark room illumination. A useful orange safe-light may be prepared by bathing a fixed-out plate for several minutes in a 5% potassium chromate solution, rinsing and then immersing in lead acetate solution, washing and drying.

**LEAD NITRATE,  $\text{Pb}(\text{NO}_3)_2$** 

Fr. Azotate de Plomb. Ger. Bleinitrat.

M. W. 331: Sp. G. 4.53: M. P. Decomposes between  $205^\circ$  and  $223^\circ \text{C}$ .

Sol. in water and alcohol.

P. White crystals; promotes combustion in contact with organic matter; poisonous.

Der. By the action of nitric acid on lead.

G. U.S.P.

U. P. Used in the lead intensifier and in some combined toning and fixing baths.

**LITHIUM BROMIDE, LiBr**

Fr. Bromure de Lithium. Ger. Bromlithium.

M. W. 87: Sp. G. 3.466: M. P. 442°-547° C.

Sol. in water, alcohol and ether.

P. White crystals. Very deliquescent, must be kept in well stoppered bottles.

Der. By the action of hydrobromic acid on lithium hydroxide with subsequent crystallization.

G. U.S.P.

U. P. On account of its solubility in ether and alcohol, it is used in collodion emulsion making.

**LITHIUM CHLORIDE, LiCl**

Fr. Chlorure de Lithium. Ger. Chlorlithium.

M. W. 42.5: Sp. G. 1.998-2.074: M. P. 602° C.

Sol. in water, alcohol and ether.

P. White crystals.

Der. By the action of hydrochloric acid on lithium hydroxide with subsequent crystallization.

G. Technical granular.

U. P. Used in collodio-chloride printing-out emulsions; has been recommended as a constituent of gelatino-chloride emulsions to increase contrast.

**MAGNESIUM BROMIDE, MgBr<sub>2</sub>·6H<sub>2</sub>O**

Fr. Bromure de Magnésium. Ger. Brommagnesium.

M. W. 291: M. P. Decomposes.

Sol. in water; Ss. in alcohol.

P. Colorless, very deliquescent crystals; bitter taste.

Der. By the action of hydrobromic acid on magnesium oxide with subsequent crystallization.

G. Technical granular.

U. P. Is used in collodion emulsion making, and has been recommended in connection with gelatino-bromide emulsions to increase contrast.

**MAGNESIUM CARBONATE,  $\text{MgCO}_3$** 

Fr. Carbonate de Magnésium. Ger. Kohlensaures Magnesium.

M. W. 84: Sp. G. 3.04: M. P. Decomposes at  $350^\circ \text{C}$ .

Sol. in acids; Ins. in water.

P. Very light, white powder, consisting of a mixture of crystals and amorphous particles.

Der. Found as such in nature.

G. U.S.P.

U. P. In process work it is used by photo-engravers for rubbing into the hollows of an etched plate so that the progress of etching may be seen; and in the form of a fine powder is used in the dry enamel process.

**MAGNESIUM CHLORIDE,  $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$** 

Fr. Chlorure de Magnésium. Ger. Chlormagnesium.

M. W. 202: Sp. G. 1.569. M. P. Loses  $2\text{H}_2\text{O}$  at  $100^\circ \text{C}$ . B. P. Decomposes.

Sol. in water and alcohol.

P. Colorless or white crystals.

Der. By the action of hydrochloric acid on magnesium oxide. Deliquescent and must be kept in well stoppered bottles.

G. Fused.

U. P. Has been suggested as a fixing agent, but is not as powerful as "hypo." Is occasionally used in collodion emulsion making.

**MERCURY CHLORIDE (Mercuric),  $\text{HgCl}_2$** 

Fr. Bichlorure de Mercure. Ger. Quecksilberchlorid.

Syn. Perchloride or Bichloride of mercury, Corrosive sublimate.

M. W. 271: Sp. G. 5.32: M. P.  $265^\circ \text{C}$ .: B. P.  $303^\circ \text{C}$ .

Sol. in water, alcohol, ether, pyridine and acetic acid ester.

P. White crystals; very poisonous. Should be kept in the dark.

Der. By subliming common salt and mercuric sulphate.

G. U.S.P.

U. P. Used as the bleaching agent in mercurial intensification. Used in small amounts in connection with the hypo alum bath, produces colder sepia tones.

**MERCURY IODIDE** (Mercuric),  $\text{HgI}_2$ 

Fr. Iodure de Mercure. Ger. Quecksilberiodid.

Syn. Red iodide of mercury, Biniodide of mercury.

M. W. 454: Sp. G. 6.2-6.32: M. P.  $241^\circ$ - $257^\circ$  C.: B. P.  $349^\circ$  C.

Sol. in sodium thiosulphate or potassium iodide solutions;  
Ins. in water.

P. A scarlet-red, amorphous powder; poisonous.

Der. Precipitated from mercuric chloride solution by potassium iodide.

G. U.S.P.

U. P. Is used in intensification, and is usually prepared direct by the reaction of mercuric chloride and potassium iodide.

**MERCURY SULPHOCYANIDE**,  $\text{Hg}(\text{SCN})_2$ 

Fr. Sulfocyanure de Mercure. Ger. Rhodanquecksilber.

Syn. Mercuric sulphocyanate and Rhodanide.

M. W. 316: M. P. Decomposes.

Sol. in alcohol; Ss. in water.

P. White powder; poisonous; explosive.

Der. By precipitation of mercuric nitrate with ammonium sulphocyanate and subsequent solution in a large amount of hot water and crystallizing.

G. Technical.

U. P. Usually prepared in solution by the reaction of mercuric chloride and potassium sulphocyanide. Is a good intensifier for negatives, giving a good black image. Further intensification can be obtained by afterwards applying a developer.

**POTASSIUM BICHROMATE,  $K_2Cr_2O_7$** 

Fr. Bichromate de Potasse. Ger. Kaliumbichromat, Saures Rotes, Chromsaures Kalium.

Syn. Potash or potassium dichromate; Acid or red potassium chromate.

M. W. 294: Sp. G. 2.692: M. P.  $396^{\circ} C.$ : B. P. Decomposes at  $500^{\circ} C.$

Sol. in water; Ins. in alcohol and ether.

P. Bright, yellowish-red, transparent crystals; bitter, metallic taste; poisonous.

Der. By heating an aqueous solution of sodium bichromate with potassium chloride, concentrating the solution, whereupon sodium chloride is deposited in the vessel. Lead rods are suspended in the solution and the bichromate crystallizes on these.

G. U.S.P.

U. P. Used in the carbon process, and many photo-mechanical processes, as it has the property of rendering gelatine, fish glue and other colloids insoluble after they have been acted upon by light. Is also used for sensitizing photo-lithographic paper, collotype plates and the albumen coating for zinc. Is used in conjunction with sulphuric acid as a glass and bottle cleaning fluid.

**POTASSIUM BROMIDE, KBr**

Fr. Bromure de Potasse. Ger. Bromkalium.

Syn. Bromide of potassium or Potash.

M. W. 119: Sp. G. 2.749: M. P.  $730^{\circ} C.$ : B. P.  $1435^{\circ} C.$

Sol. in water; Ss. in alcohol and ether.

P. White crystalline granules or powder; pungent, strong, bitter saline taste; somewhat hygroscopic.

Der. Potassium hydroxide in hot solution is treated with bromine, the solution evaporated to dryness, the residue mixed with carbon and heated to redness.

G. U.S.P.

U. P. Its principal use is in the manufacture of gelatinobromide emulsions. It also acts as a restrainer in development, and is most active with pyro, hydroquinone, and para-amidophenol. In process work it is used in making up the copper bromide intensifying solution for wet plate negatives.



**POTASSIUM CARBONATE,  $K_2CO_3$** 

Fr. Carbonate de Potasse. Ger. Pottasche, Kohlensaures Kalium.

Syn. Potash, Pearlash, Subcarbonate of potash, Salt of tartar, Salt of wormwood.

M. W. 138: Sp. G. 2.3312: M. P.  $909^\circ$  C.: B. P. Volatile at white heat.

Sol. in water; Ins. in alcohol and ether.

P. White, deliquescent, granular powder; alkaline reaction.

Der. Obtained from wood ashes.

G. U.S.P.

U. P. Used as an accelerator in development.

**POTASSIUM CHLORATE,  $KClO_3$** 

Fr. Chlorate de Potasse. Ger. Chlorsaures Kalium.

Syn. Chlorate of potash.

M. W. 122.5: Sp. G. 2.337: M. P.  $357^\circ$  C.: B. P. Decomposes at about  $400^\circ$  C., giving off oxygen.

Sol. in water and alkalis; Ss. in alcohol.

P. Transparent, colorless crystals or white powder; cooling saline taste; poisonous; must not be ground with sugar, sulphur or other combustible substances, may cause explosions.

Der. By electrolyzing a hot concentrated alkaline solution of potassium chloride.

G. U.S.P.

U. P. Sometimes used in the sensitizer for platinotype paper to give brilliancy to the image. Its principal use, however, being in flashlight mixtures. In process work, is used with hydrochloric acid as an etching solution for copper and steel, known as the Dutch mordant.

**POTASSIUM CHLORIDE, KCl**

Fr. Chlorure de Potasse. Ger. Chlorkalium.

- M. W. 74.5; Sp. G. 1.987; M. P. 772° C.; B. P. Decomposes at about 400° C.  
Sol. in water and alkalis; Ss. in alcohol; Ins. in absolute alcohol.  
P. Colorless or white crystals or powder; strong saline taste.  
Der. Prepared by neutralizing hydrochloric acid with potassium carbonate.  
G. Granular.  
U. P. Used in emulsion making.

**POTASSIUM CHLOROPLATINITE, K<sub>2</sub>PtCl<sub>6</sub>**

Fr. Chloroplatinite de Potassium.

Ger. Platinchloruskalium.

- Syn. Chloroplatinite or platinochloride of potash.  
M. W. 413.4; Sp. G. 3.291.  
Sol. in water; Ins. in alcohol.  
P. Ruby-red, deliquescent crystals.  
Der. By adding potassium carbonate to a solution of chloroplatinous acid.  
G. Special photographic.  
U. P. Used in the platinotype process and as one of the ingredients of toning baths for silver prints.

**POTASSIUM CHROMATE, K<sub>2</sub>CrO<sub>4</sub>**

Fr. Chromate de Potasse. Ger. Chromsaures Kalium.

- Syn. Neutral or yellowish chromate of potash.  
M. W. 194; Sp. G. 2.7319; M. P. 971° C.  
Sol. in water; Ins. in alcohol.  
P. Yellow crystals.  
Der. By adding potassium carbonate to a solution of potassium bichromate and crystallizing.  
G. Technical.  
U. P. Sometimes used as a liquid light filter in sensitometry or three-color work. In process work, the chromate has been used as a sensitizer in place of bichromates, but is not as satisfactory.

**POTASSIUM CITRATE,  $K_3C_6H_5O_7H_2O$** 

Fr. Citrate de Potasse. Ger. Citronensaures Kalium.

Syn. Tribasic citrate of potash.

M. W. 342: Sp. G. 1.98: M. P. Decomposes when heated to about  $230^{\circ}$  C.

Sol. in water and alcohol.

P. Colorless or white crystals or powder; extremely deliquescent.

Der. By the action of citric acid on potassium carbonate.

G. U.S.P.

U. P. Is used as a restrainer in alkaline development, and in several of the copper toning baths. Because of its deliquescent nature it is best to prepare this salt in solution; the stronger the solution, the better it will keep; dilute solutions very soon grow a fungus.

**POTASSIUM CYANIDE, KCN**

Fr. Cyanure de Potassium. Ger. Cyankalium.

Syn. Cyanide of potash, Cyanide.

M. W. 65: Sp. G. 1.52: M. P. At red-heat.: B. P. At red-heat.

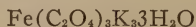
Sol. in water, alcohol and glycerin.

P. White, amorphous, deliquescent lumps or crystalline mass; faint odor of bitter almonds; extremely poisonous, do not handle with bare hands!

Der. Prepared by fusing potassium ferrocyanide with potassium carbonate in an iron crucible.

G. Pure granulated.

U. P. Used as a fixing agent in collodion processes and sometimes as a clearing agent for bromide prints, also used in Monckhoven's intensifier. In process work, is used for fixing wet collodion negatives and for cutting or reducing solution. Is also used in connection with electro-deposition and for degreasing articles previous to plating.

**POTASSIUM FERRIC OXALATE,**

Fr. Oxalate Potassico-Ferrique. Ger. Kalium-Ferri-Oxalat.

M. W. 491.

Sol. in water; Ins. in alcohol.

P. Bright green crystals.

Der. By acidulating potassium ferrous oxalate and exposing to light.

U. P. Used in Belitski's reducer and in several iron printing processes.

**POTASSIUM FERRICYANIDE,  $\text{K}_3\text{Fe}(\text{CN})_6$** 

Fr. Cyanoferride de Potassium. Ger. Ferrid-Cyan-Kalium.

Syn. Ferricyanide of potash, Red prussiate of potash.

M. W. 329: Sp. G. 1.8109: M. P. Decomposes when heated.

Sol. in water; Ss. in alcohol.

P. Bright-red, lustrous crystals, the crystals often become coated with a yellowish powder, this powder should be washed off before using. Poisonous.

Der. Chlorine is passed into a solution of potassium ferrocyanide, the ferricyanide separating out.

G. Pure crystals.

U. P. Used in several iron printing processes, but its principal use is in conjunction with hypo, forming Farmer's reducer. In conjunction with potassium bromide is used for bleaching bromide or gaslight prints previous to sulphiding. In process work, is one of the ingredients of the lead nitrate intensifier.

**POTASSIUM FERROCYANIDE,  $K_4Fe(CN)_6 \cdot 3H_2O$** 

Fr. Cyanoferrure de Potassium. Ger. Ferrocyankalium.

Syn. Ferrocyanide of potash, Yellow prussiate of potash.

M. W. 422: M. P. Loses its water of crystallization when heated to  $60^\circ C.$ : B. P. Decomposes when heated to red-heat.

Sol. in water; Ins. in alcohol.

P. Lemon-yellow crystals or powder; effloresces on exposure to air.

Der. Obtained by fusing potassium carbonate with horn clippings, and stirring with an iron agitator.

G. U.S.P.

U. P. Used as a developer in some iron printing processes. The addition of a small amount to pyro and hydroquinone developers has been recommended as a means of lowering fog and giving greater density. A weak solution is used as one of the test reagents for identifying iron and other metallic spots in paper raw stock.

**POTASSIUM FLUORIDE,  $KF_2H_2O$** 

Fr. Fluorure de Potassium. Ger. Fluorkalium.

M. W. 94: M. P.  $41^\circ C.$

Sol. in water and hydrofluoric acid; Ins. in alcohol.

P. White crystalline, deliquescent powder; sharp saline taste.

Der. By saturation of hydrofluoric acid with potassium carbonate.

G. Technical.

U. P. Used for stripping films from glass negatives. A five-minute immersion in a 2% solution with subsequent immersion in a 2% solution of sulphuric acid is sufficient. It keeps better than hydrofluoric acid and does not as strongly attack the skin, lungs or mucous membranes.

**POTASSIUM HYDRATE, KOH**

Fr. Potasse Caustique. Ger. Aetzkali.

Syn. Caustic potash, Potassium hydroxide.

M. W. 56: Sp. G. 2.044: M. P. 360.4° C.: B. P. Sublimes when heated above melting point.

Sol. in water and alcohol; Ss. in ether.

P. White, deliquescent lumps or sticks. It readily attacks corks and glass stoppers, these should be waxed or paraffined. Must not be handled, as it is a very powerful escharotic inflicting severe burns upon the skin; poisonous.

Der. Obtained by decomposing potassium carbonate with milk of lime.

G. U.S.P.

U. P. Used as an accelerator in alkaline development. In process work, crude caustic potash is used for cleaning old negative glasses, and for taking the ink and resist off copper and zinc plates after etching. It is also used for cleaning articles previous to electro-plating.

**POTASSIUM IODIDE, KI**

Fr. Iodure de Potassium. Ger. Iodkali.

Syn. Iodide of potash.

M. W. 166: Sp. G. 3.123: M. P. 680° C.: B. P. 1420° C.

Sol. in water, alcohol and ether.

P. White crystals, granules or powder; strong bitter saline taste.

Der. A hot solution of potassium hydroxide is treated with iodine, evaporated to dryness, mixed with carbon and heated to redness.

G. U.S.P.

U. P. Used in the preparation of the mercuric iodide intensifier. Used in emulsion making, particularly in conjunction with gelatino-bromide emulsions; has the property of reducing emulsion fog, increasing contrast, and giving increased density. The use of more than a small percentage, however, yields an emulsion which is slow in fixing. It is generally conceded that a complex double salt of bromo-iodide of silver is formed and is responsible for the particular character and photographic quality of bromo-iodide emulsions. A very small amount of a 1% solution added to a finished emulsion, enormously decreases its speed. Is also used in some of the more modern dye mordanting processes.



**POTASSIUM METABISULPHITE,  $K_2S_2O_5$** 

Fr. Métabisulfite de Potassium. Ger. Kaliummetabisulfit.

Syn. Metabisulphite of potash, Potassium pyrosulphite.

M. W. 222.

Ss. in water; Ins. in alcohol.

P. Clear, transparent crystals; smelling of sulphurous acid gas.

Der. By heating potassium bisulphite until it loses water.

G. Granular photographic.

U. P. Used as a preservative in developers, and for acidulating hypo baths. Lately sodium metabisulphite has been introduced to take the place of the potassium salt.

**POTASSIUM NITRATE,  $KNO_3$** 

Fr. Azotate de Potasse. Ger. Salpetersaures Kali.

Syn. Nitrate of potash, Nitre, Saltpetre.

M. W. 101: Sp. G. 2.1062: M. P.  $337^{\circ} C.$ : B. P. Decomposes with deflagration at about  $400^{\circ} C.$

Sol. in water; Ins. in alcohol and ether.

P. Transparent, colorless or white crystalline powder or crystals; cooling, pungent, saline taste.

Der. Sodium nitrate and potassium chloride in solution are evaporated until sodium chloride crystallizes out, then decanted and crystallized. G. U.S.P.

U. P. Used in the manufacture of pyroxyline and flash powders. Has been recommended as an addition to an emulsion to prevent fog.

**POTASSIUM OXALATE,  $K_2C_2O_4 \cdot H_2O$** 

Fr. Oxalate Neutre de Potasse. Ger. Neutrales Oxalsäures Kali, Kaliumoxalat.

Syn. Neutral oxalate of potash.

M. W. 184: Sp. G. 2.08: M. P. Decomposes when heated.

Sol. in water; Ins. in alcohol and ether.

P. Colorless, transparent crystals.

Der. Obtained by saturating acid oxalate of potash, or oxalic acid, with potassium carbonate.

G. Photographic.

U. P. Used in the ferrous oxalate developer, and as a developer for platinotypes.

**POTASSIUM PERCARBONATE,  $K_2C_2O_6H_2O$** 

Fr. Percarbonate de Potasse. Ger. Kaliumpercarbonat.

M. W. 216.

Ss. in water.

P. White, crystalline powder.

Der. Obtained by electrolysis of potassium carbonate.

G. Technical.

U. P. Used as a hypo eliminator, and has been sold under many different trade names.

**POTASSIUM PERCHLORATE,  $KClO_4$** 

Fr. Perchlorure de Potassium. Ger. Ueberchlorsaures Kali.

M. W. 138.5.

Ss. in water; Ins. in alcohol.

P. Colorless powder or rhombic crystals.

G. Technical.

U. P. Used in flashlight mixtures. Should be mixed with the same precaution as potassium chlorate.

**POTASSIUM PERMANGANATE,  $KMnO_4$** 

Fr. Permanganate de Potasse.

Ger. Uebermangansaures Kali.

Syn. Permanganate of potash.

M. W. 158: Sp. G. 2.7032: M. P. Decomposes at  $240^{\circ}$  C.

Sol. in water, sulphuric and acetic acids and alcohol.

P. Dark purple crystals having a blue metallic sheen; sweetish, astringent taste.

Der. Obtained by fusing manganese peroxide with potassium hydrate or nitrate.

G. U.S.P.

U. P. Used as a reducer for negatives, and when acidulated with sulphuric acid reduces the high-lights more than the shadows. Used as a neutral solution, it to all intents and purposes is an intensifier, as a manganese salt is precipitated on the silver image rendering it slightly non-actinic in color. Is used as the reverser in several screen plate color processes. Used as a test for the presence of hypo and as a hypo eliminator. In process work, a small amount of a 10% solution is used to rid the wet collodion silver bath of organic impurities.

**POTASSIUM PERSULPHATE,  $K_2S_2O_8$** 

Fr. Persulphate de Potasse.  
Ger. Ueberschwefelsaures Kali.

Syn. Persulphate of potash, Anthion.

M. W. 270. M. P. Decomposes below  $100^\circ$  C.

Sol. in water; Ins. in alcohol.

P. White crystals.

Der. By electrolysis of a saturated solution of potassium sulphate.

G. Technical.

U. P. Used as a hypo eliminator and has been sold under various trade names. May also be used as a reducer in place of ammonium persulphate and has the advantage that it is less likely to contain injurious impurities.

**POTASSIUM AND SODIUM TARTRATE,**

Fr. Sel de Seignette. Ger. Seignettesalz, Rochellesalz,  
Weinsaures Kalinatron.

Syn. Rochelle or Seignette salts.

M. W. 282: Sp. G. 1.77: M. P.  $70^\circ$ - $80^\circ$  C.: B. P. Loses  $4H_2O$  at  $215^\circ$  C.

Sol. in water; Ins. in alcohol.

P. Colorless, transparent crystals or white powder.

Der. Obtained by boiling together cream of tartar and sodium carbonate. G. U.S.P.

U. P. Used in printing-out emulsions to form silver tartrate.

**POTASSIUM SULPHIDE,  $K_2S_3$** 

Fr. Foie de Soufre. Ger. Schwefelkalium, Schwefelleber.

Syn. Liver of sulphurated potash, Potassium trisulphide.

M. W. 174: Sp. G. 1.805.

Sol. in water, alcohol and glycerine; Ins. in ether.

P. Deliquescent, red, crystalline mass; should be kept well stoppered.

Der. Obtained by fusing sulphur and potassium carbonate.

G. Technical.

U. P. Used to precipitate the silver from waste photographic solutions, but recently has been almost entirely replaced by sodium sulphide for this purpose.

**POTASSIUM SULPHOCYANIDE, KCNS**

Fr. Sulfocyanure de Potassium. Ger. Rhodankalium,  
Schwefelcyankalium.

Syn. Potassium thiocyanate, Sulphocyanate, or Rhodanide.

M. W. 97: Sp. G. 1.906: M. P.  $172.3^{\circ}$  C.: B. P. Decomposes  
at  $500^{\circ}$  C.

Sol. in water, alcohol and acetone.

P. Transparent, deliquescent crystals. Must be kept well  
stoppered.

Der. By heating potassium cyanide with sulphur.

G. Pure.

U. P. Used in the sulphocyanide toning bath. Is a solvent  
for gelatine and therefore has been used in the develop-  
ment of over-exposed carbon prints.

**SILVER ACETATE,  $\text{AgC}_2\text{H}_3\text{O}_2$** 

Fr. Acétate d'Argent. Ger. Silberacetat.

M. W. 167.

Sol. in water; Ins. in alcohol.

P. Fine white powder or crystals.

Der. By adding an alkaline acetate to silver nitrate solution  
or by dissolving silver carbonate in glacial acetic acid.

U. P. Has been recommended for use in printing-out papers,  
but it yields an image of poor quality and its sensitive-  
ness is about one-twentieth of that of silver chloride.

**SILVER AMMONIO-CARBONATE,  $\text{Ag}_2\text{CO}_3\cdot 4\text{NH}_3$** 

Fr. Ammonio-Carbonate d'Argent. Ger. Kohlensaures  
Silberoxydammoniak.

M. W. 229.

Sol. in water and alcohol.

P. Not found in the solid form.

Der. Prepared by adding a solution of ammonium car-  
bonate to a solution of silver nitrate.

U. P. Sometimes used in emulsion making, particularly in  
positive or lantern slide emulsions.

**SILVER AMMONIO-NITRATE,  $\text{AgNO}_3\cdot 2\text{NH}_3$** 

Fr. Ammonio-Nitrate d'Argent. Ger. Salpetersaures Silberoxydammoniak.

Syn. Ammonio-oxide of silver.

M. W. 204.

Sol. in water and alcohol.

P. Colorless needles, but rarely exists in the solid form, being formed in the ammonio-nitrate emulsion making processes.

Der. By mixing a solution of ammonia with silver nitrate until the precipitate first formed is redissolved.

U. P. A solution of silver ammonio-nitrate is sometimes used for sensitizing plain paper, but its principal use is in emulsion making to form silver bromide. Emulsions prepared by the ammonio-nitrate process do not have to be ripened by heating, as ammonia takes the place of heat.

**SILVER BROMIDE,  $\text{AgBr}$** 

Fr. Bromure d'Argent. Ger. Bromsilber.

Syn. Bromide of silver.

M. W. 188: Sp. G. 6.473: M. P.  $427^\circ \text{C}$ .: B. P. Decomposes at  $700^\circ \text{C}$ .

Sol. in sodium thiosulphate, potassium bromide and potassium cyanide solutions; practically Ins. in water and ammonium hydroxide.

P. Yellow amorphous powder.

Der. Obtained by adding any soluble bromide to silver nitrate solution. In photography, it is always prepared in the presence of some vehicle which will suspend it in the form of an emulsion, and prevent it from forming coarse clots.

U. P. Silver bromide is the basis of the modern gelatino-bromide emulsions, and is the most light sensitive silver salt.

**SILVER CARBONATE,  $\text{Ag}_2\text{CO}_3$** 

Fr. Carbonate d'Argent. Ger. Kohlensaures Silberoxyd.

M. W. 276.

Sol. in potassium cyanide, ammonia and sodium thiosulphate;  
Ins. in water and alcohol.

P. Yellow granular powder.

Der. By adding an alkaline carbonate to silver nitrate solution.

U. P. Sometimes formed in the preparation of printing-out, gaslight and negative emulsions.

**SILVER CHLORIDE,  $\text{AgCl}$** 

Fr. Chlorure d'Argent. Ger. Chlorsilber.

Syn. Chloride of silver, Horn silver, Muriate of silver.

M. W. 143.5: Sp. G. 5.561: M. P.  $451^\circ \text{C}$ .

Sol. in sodium thiosulphate and potassium bromide solutions, concentrated sulphuric acid and ammonium hydroxide;  
practically Ins. in water.

P. White granular powder, which darkens on exposure to light, finally turning black.

Der. Obtained by adding a soluble chloride to silver nitrate solution.

U. P. Formed in the preparation of printing-out emulsions and positive emulsions. The higher the proportion of silver chloride in an emulsion, the shorter the gradation scale.

**SILVER CHROMATE,  $\text{Ag}_2\text{CrO}_4$** 

Fr. Chromate d'Argent. Ger. Silberchromat.

M. W. 332.

Sol. in ammonia and sodium thiosulphate; Ins. in water, alcohol and ether.

P. Red amorphous powder.

Der. Obtained by adding potassium chromate to silver nitrate solution.

U. P. The formation of a small amount of this salt in a printing-out emulsion reduces the scale of gradation, making a more contrasty paper suitable for weak negatives.



**SILVER CITRATE,  $\text{AgC}_6\text{H}_5\text{O}_7$** 

Fr. Citrate d'Argent. Ger. Silbercitrate, Citronensaures Silberoxyd.

Syn. Citrate of silver. M. W. 297.

Sol. in ammonia, sodium thiosulphate and potassium cyanide; Ins. in water, alcohol and ether.

P. Curdy white powder.

Der. Obtained by adding an alkaline citrate to silver nitrate solution.

U. P. When formed in small proportions in printing-out emulsions, has a definite influence on the keeping quality of the paper—seemingly it has a preservative effect. Formed in silver chloride gaslight emulsions, it tends to increase contrast and reduce fog.

**SILVER CYANIDE,  $\text{AgCN}$** 

Fr. Cyanure d'Argent. Ger. Silbercyanid.

M. W. 134: Sp. G. 3.95: M. P. Decomposes when heated.

Sol. in ammonia, potassium cyanide and sodium thiosulphate solutions; Ins. in water, alcohol and ether.

P. White powder which darkens on exposure to light; very poisonous.

Der. Obtained by adding an alkaline cyanide to a solution of silver nitrate.

U. P. Formed in the preparation of the blackening solution in Monckhoven's intensifier.

**SILVER IODIDE,  $\text{AgI}$** 

Fr. Iodure d'Argent. Ger. Iodsilber.

M. W. 235: Sp. G. 5.675: M. P.  $556^\circ \text{C}$ .

Sol. in potassium cyanide and sodium thiosulphate solutions.

Ins. in water, ammonia, alcohol and ether.

P. Pale yellow powder, darkening on exposure to light.

Der. Obtained by adding a soluble iodide to silver nitrate solution.

U. P. Silver Iodide is sometimes formed in small proportions in gelatino-bromide emulsions, tending to restrain fog during digestion and produces greater sensitiveness (see Potassium Iodide). Silver Iodide is also employed in the wet plate process. The negative silver bath for sensitizing wet collodion plates should be saturated with silver iodide before using.

**SILVER NITRATE,  $\text{AgNO}_3$** 

Fr. Azotate d'Argent. Ger. Silbernitrat, Salpetersaures Silber.

M. W. 170: Sp. G. 4.352: M. P.  $218^\circ \text{C}$ : B. P. Decomposes.

Sol. in water, ether and glycerine; Ss. in alcohol.

P. Colorless, rhombic plates. Is not in itself sensitive to light, but is very easily reduced to the metallic state in the presence of organic materials: as the skin, paper or gelatine.

Der. Silver is dissolved in dilute nitric acid, the solution evaporated.

G. Pure crystals, photographic.

U. P. Silver Nitrate is the salt from which are made all the sensitive materials of photography in which silver is used. In process work, is occasionally used in the etching bath for steel plates.

**SILVER PHOSPHATE,  $\text{Ag}_3\text{PO}_4$** 

Fr. Phosphate d'Argent. Ger. Silberphosphat.

Syn. Normal silver orthophosphat.

M. W. 419: Sp. G. 7.321: M. P.  $849^\circ \text{C}$ .

Sol. in ammonia, potassium cyanide and sodium thiosulphate solutions, and organic acids; Ins. in water, alcohol and ether.

P. Heavy yellow powder; turns brown when heated, or on exposure to light.

Der. Obtained by adding phosphoric acid to silver nitrate solution.

U. P. When formed in small proportions in printing-out emulsions, gives a long scale of gradation suitable for soft prints from hard negatives; acts very similarly when formed in silver chloride gaslight emulsions.

**SILVER SULPHIDE,  $\text{Ag}_2\text{S}$** 

Fr. Sulfure d'Argent. Ger. Silbersulfid.

M. W. 248: Sp. G. 6.85-7.32: M. P.  $842^\circ \text{C}$ .: B. P. Decomposes.

Sol. in concentrated sulphuric and nitric acids; Ins. in water and alcohol.

P. A brownish-black powder.

Der. Obtained by mixing an alkaline sulphide with silver nitrate solution. Also formed when liver of sulphur is added to old hypo baths.

U. P. Silver sulphide is the salt formed when gaslight or bromide prints are sepia toned in the sulphide bath.

**SODIUM ACETATE,  $\text{NaC}_2\text{H}_3\text{O}_2 \cdot 3\text{H}_2\text{O}$** 

Fr. Acétate de Soude. Ger. Essigsaures Natron.

Syn. Acetate of soda.

M. W. 136: Sp. G. 1.4: M. P.  $58^\circ \text{C}$ .

Sol. in water; Ss. in alcohol.

P. Colorless, transparent, efflorescent crystals.

Der. Prepared by neutralizing acetic acid with sodium carbonate.

G. U.S.P. Granulated.

U. P. Used in the gold toning bath. Double fused sodium acetate is sometimes used, having a slight alkaline reaction, makes the toning bath work more quickly. It is also more free of organic impurities.

**SODIUM BICHROMATE**,  $\text{Na}_2\text{Cr}_2\text{O}_7 \cdot 2\text{H}_2\text{O}$ 

Fr. Bichromate de Soude. Ger. Doppelt Chromsaures Natron.

Syn. Dichromate of soda, Acid sodium chromate.

M. W. 298: Sp. G. 2.52: M. P. Loses  $2\text{H}_2\text{O}$  at  $100^\circ \text{C}$ .:  
B. P. Decomposes.

Sol. in water; Ins. in alcohol.

P. Red, deliquescent, crystalline fragments.

Der. Obtained in similar manner to potassium salt. (QV.)

G. Technical.

U. P. Used in the same manner and for the same purposes as the potassium salt. One part of potassium bichromate is equivalent to 1.10 parts of sodium bichromate. In process work, is sometimes used to replace the ammonium and potassium salts for sensitizing, but its deliquescent nature is a disadvantage.

**SODIUM BISULPHITE**,  $\text{NaHSO}_3$ 

Fr. Bisulfite de Soude. Ger. Saures Schwefeligsäures Natron, Natrium Bisulfit.

Syn. Acid sulphite of soda.

M. W. 104: Sp. G. 1.48: M. P. Decomposes.

Sol. in water; Ins. in alcohol.

P. White crystalline powder; faint sulphurous odor.

Der. Prepared by passing sulphurous acid gas through carbonate of soda solution.

G. U.S.P. or special photographic.

U. P. Used for acidulating and preserving fixing baths supplying both the sulphite and acid necessary. For preparing neutral sulphite solution which is extensively used as a preservative for pyro developer. Can be substituted weight for weight for potassium metabisulphite. For photographic purposes, sodium bisulphite should be free from iron.

**SODIUM BORATE,  $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$** 

Fr. Borate de Soude. Ger. Borax, Borsaures Natron.

Syn. Borax, Sodium tetraborate, Pyroborate, Biborate.

M. W. 382: M. P. Red-heat.

Sol. in water and glycerine; Ins. in alcohol.

P. White crystals or powder.

Der. Obtained from the native borax, or by neutralization of native boric acid.

G. U.S.P.

U. P. Used in gold toning baths, and as an accelerator with hydroquinone and eikonogen developers. Can be used as a restrainer with the metol-hydroquinone developer for gaslight papers, and produces a print having a warm brownish-black.

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**SODIUM CARBONATE,**

$\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$  (cryst)  $\cdot$   $\text{Na}_2\text{CO}_3$  (dry)

Fr. Carbonate de Soude. Ger. Soda, Kohlensaures Natron, Natriumcarbonat.

Syn. Soda, Washing soda, Carbonate of soda.

M. W. 286: Sp. G. 1.446: M. P. Loses  $5\text{H}_2\text{O}$  at  $12.5^\circ \text{C}$ ., and melts at  $34^\circ \text{C}$ .: B. P.  $106^\circ \text{C}$ .

Sol. in water and glycerine; Ins. in alcohol.

P. Colorless crystals or white powder; strong alkaline taste; effloresces in air.

Der. Obtained by converting salt into sodium sulphate, and then decomposing the latter by roasting with limestone and coal.

G. U.S.P.

U. P. Sodium carbonate is the principal alkali used for developers; in addition to the crystal form there is a grade known as "dry powder" which is extensively used. For all practical work, 37 parts of the dry powder are equivalent to 100 of the crystals.

**SODIUM CHLORIDE, NaCl**

Fr. Chlorure de Soude, Selmarin. Ger. Chlornatrium,  
Sal Gemmae.

Syn. Muriate or chloride of soda, Salt, Common table-salt.

M. W. 58.5: Sp. G. 2.161: M. P. 804° C.: B. P. 1490° C.

Sol. in water; practically Ins. in alcohol; Ins. in concentrated hydrochloric acid.

P. Colorless, transparent crystals or white, crystalline powder.

Der. Obtained native or by purification from sea water.

G. U.S.P.

U. P. Used in the preparation of chloride emulsions. Also acts as a restrainer, but is weaker than the alkaline bromides.

**SODIUM CITRATE,  $2\text{Na}_3\text{C}_6\text{H}_5\text{O}_7 \cdot 11\text{H}_2\text{O}$** 

Fr. Citrate de Soude. Ger. Citronensaures Natron.

Syn. Citrate of soda, Neutral citrate of soda.

M. W. 714: M. P. Loses  $11\text{H}_2\text{O}$  at 150° C.: B. P. Decomposes.

Sol. in water; Ss. in alcohol.

P. White crystals or granular powder; pleasant acid taste; very deliquescent.

Der. Obtained by neutralizing citric acid with sodium carbonate.

G. U.S.P.

U. P. Used as a preservative in albumen papers, also to form silver citrate in printing-out emulsions. Is also used as a restrainer in development.



**SODIUM HYDRATE (Caustic), NaOH**

Fr. Soude Caustique. Ger. Aetznatron.

Syn. Caustic soda, Sodium hydroxide.

M. W. 40: Sp. G. 2.13: M. P. 318° C.: B. P. White heat.

Sol. in water, alcohol and glycerine.

P. White, deliquescent pieces, lumps or sticks; crystalline fracture. Keep well stoppered, absorbs water and carbon dioxide from the air. Should not be handled with the fingers.

Der. Obtained by decomposing sodium carbonate with lime.

G. U.S.P.

U. P. Used as an accelerator in development. Most generally used with low energy developers, as hydroquinon, etc.

**SODIUM NITRATE, NaNO<sub>3</sub>**

Fr. Azotate de Soude. Ger. Salpetersaures Natron.

Syn. Cubic, Chili, or Soda nitre or Saltpetre.

M. W. 85: Sp. G. 2.267: M. P. 316° C.: B. P. Decomposes.

Sol. in water and glycerine; Ss. in alcohol.

P. Colorless, transparent crystals.

Der. Found native.

G. U.S.P.

U. P. Not often used in photography, although it is credited with imparting a brownish-black tone to developed silver images.

**SODIUM NITRITE, NaNO<sub>2</sub>**

Fr. Azotite de Soude. Ger. Salpetrigsaures Natron.

Syn. Nitrite of soda.

M. W. 69: Sp. G. 2.157: M. P. 213° C.: B. P. Decomposes.

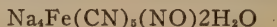
Sol. in water; Ss. in alcohol and ether.

P. Slightly yellowish or white crystals.

Der. Prepared by fusing the nitrate or neutralizing nitrous acid.

G. U.S.P.

U. P. Used in the diazotype process and in the preparation of photometer paper.

**SODIUM NITROPRUSSIDE**

Fr. Nitroprussiate de Soude. Ger. Nitroprussidnatrium.

Syn. Sodium nitroprussiate.

M. W. 298; Sp. G. 1.6803.

Sol. in water and alcohol.

P. Ruby-red, transparent crystals.

Der. Sodium ferrocyanide solution is treated with nitric acid.

G. Pure.

U. P. Is one of the most light sensitive iron salts, and is sometimes used in iron printing processes.

**SODIUM OXALATE,  $\text{Na}_2\text{C}_2\text{O}_4$** 

Fr. Oxalate de Soude. Ger. Oxalsäures Natrium.

Syn. Oxalate of soda.

M. W. 134.

Sol. in water; Ins. in alcohol.

P. White, crystalline powder; poisonous.

Der. By neutralizing an oxalic acid solution with sodium carbonate.

G. Pure.

U. P. Not often used because of its low solubility; is, however, sometimes used in the platinotype process.

**SODIUM PHOSPHATE,  $\text{Na}_2\text{HPO}_4 \cdot 12\text{H}_2\text{O}$** 

Fr. Phosphate de Soude. Ger. Phosphorsäures Natrium.

Syn. Disodium phosphate, Disodium orth-phosphate.

M. W. 358; Sp. G. 1.5235; M. P.  $35^\circ \text{C}$ .; B. P. Loses  $12\text{H}_2\text{O}$  at  $100^\circ \text{C}$ .

Sol. in water; Ins. in alcohol.

P. Colorless, transparent crystals.

Der. By treating calcium phosphate with carbonate of soda.

G. U.S.P.

U. P. Used in gold toning baths and sometimes in connection with silver chloride emulsions.

**SODIUM SILICATE,  $\text{Na}_2\text{SiO}_3$** 

Fr. Silicate de Soude. Ger. Natronwasserglas.

Syn. Soluble glass, Soda water-glass.

M. W. 124; M. P.  $1018^\circ \text{C}$ .

Sol. in water and alkalis; Ins. in alcohol and acids.

P. White to gray-white lumps or powder. Also obtainable in a commercial form as a syrupy yellowish liquid.

Der. Silica, calcined soda and coal are heated together in a crucible, the mass when cold, is extracted with water, followed by evaporation of the water.

G. Usually bought in the grade known as "Technical solution."

U. P. Used principally in process work, either alone or with albumen to form a substratum for coating collotype printing plates.

**SODIUM SULPHANTIMONIATE,  $\text{Na}_3\text{SbS}_5 \cdot 9\text{H}_2\text{O}$** 

Fr. Sulfoantimoniate de Soude, Sel de Schlippe.

Ger. Schlippinesche Salz.

Syn. Schlippe's salt, Sodium thioantimonate.

M. W. 479.

Sol. in water.

P. Colorless or yellow crystals.

Der. Obtained by boiling sulphide of antimony, milk of lime and sodium carbonate.

G. Pure.

U. P. Used for blackening negatives after bleaching with mercuric chloride, and sometimes used for toning bromide prints.

**SODIUM SULPHATE,  $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$** 

Fr. Sulfate de Soude. Ger. Schwefelsaures Natron.

Syn. Glauber's salt.

M. W. 322.

Sol. in water; Ins. in alcohol.

P. Colorless, efflorescent crystals.

Der. Is yielded as a by-product in the salt cake process.

G. Technical.

U. P. Finds considerable use in the preparation of barium sulphate for surface coating photographic raw paper stock.

**SODIUM SULPHIDE,  $\text{Na}_2\text{S} \cdot 9\text{H}_2\text{O}$** 

Fr. Sulfure de Soude. Ger. Natrimsulfid.

Syn. Sulphide of soda.

M. W. 240: Sp. G. 1.856.

Sol. in water; Ss. in alcohol; Ins. in ether.

P. Yellow or brick-red lumps. Deliquescent, must be kept well stoppered.

Der. Prepared by fusing sodium carbonate with sulphur.

G. Technical.

U. P. Used for the sulphide toning of bromide and gaslight prints. Sodium sulphide should not be kept near sensitive materials as it is likely to fog them and bring about deterioration. In process work, a three to five per cent. solution is used as the blackening agent in the intensification of wet collodion negatives; for this purpose it is better than ammonium sulphide.

**SODIUM SULPHITE,**

$\text{Na}_2\text{SO}_3 \cdot 7\text{H}_2\text{O}$  (cryst)  $\text{Na}_2\text{SO}_3$  (dry)

Fr. Sulfite de Soude. Ger. Natriumsulfid.

Syn. Sulphite of soda.

M. W. 252: Sp. G. 1.5939: M. P. Loses  $7\text{H}_2\text{O}$  at  $150^\circ \text{C}$ .:  
B. P. Decomposes.

Sol. in water; Ins. in alcohol.

P. White crystals or powder. The crystals are efflorescent, becoming readily oxidized to sulphate.

Der. Prepared by passing sulphurous acid gas over moistened sodium carbonate.

G. U.S.P. Crystals or Dry Powder.

U. P. Sodium sulphite is a vigorous absorbent of oxygen, therefore it is used as a preservative of developing agents. It is one of the constituents of the acid fixing bath. The dry powder form, which is now almost universally used in photography, is twice as strong in sulphite as the crystalline.

**SODIUM THIOSULPHATE,  $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$** 

Fr. Hyposulfite de Soude. Ger. Fixirnatron,  
Unterschwefligsaures Natron.

Syn. Sodium hyposulphite.

M. W. 248: Sp. G. 1.729: M. P.  $48^\circ \text{C}$ .: B. P. Decomposes.

Sol. in water and oil of turpentine; Ins. in alcohol.

P. White, transparent crystals.

Der. The crude sulphide liquors resulting from the Le Blanc soda process are exposed to air and oxidized, yielding calcium thiosulphate. This solution is boiled with sodium sulphate and subsequently crystallized.

G. Technical.

U. P. Its principal use is in the preparation of fixing baths for films, plates and papers. It is one of the ingredients of Farmer's ferricyanide-hypo reducer.

**SODIUM VANADATE,  $\text{Na}_3\text{VO}_4$** 

Fr. Vanadate de Soude. Ger. Natriumvanadat.

Syn. Sodium orthovanadat.

M. W. 184: M. P.  $866^\circ \text{C}$ .

Sol. in water; Ins. in alcohol.

P. White, crystalline powder.

Der. By solution of ammonium vanadate in sodium hydroxide solution and crystallization.

U. P. Sometimes used to increase the contrast of printing-out emulsions.

**STARCH,  $\text{C}_6\text{H}_{10}\text{O}_5$** 

Fr. Amidon. Ger. Stärke.

Sp. G. 1.499-1.513: M. P. Does not melt: B. P. Decomposes and chars.

Ins. in cold water, alcohol and ether. Makes a jelly with hot water.

P. White, amorphous powder. Starch when heated to about  $204^\circ \text{C}$ . is converted into dextrine.

Der. From corn, maize, rice, potatoes, arrow root, etc.

U. P. Used in the preparation of photographic mountants, and also for sizing photographic paper. Is sometimes used as a matting agent, being added to emulsions to dull the surface.

**STRONTIUM BROMIDE,  $\text{SrBr}_2 \cdot 6\text{H}_2\text{O}$** 

Fr. Bromure de Strontium. Ger. Strontiumbromid.

Syn. Bromide of strontia.

M. W. 355.5.

Sol. in water; Ss. in alcohol.

P. Colorless crystals.

Der. Prepared by neutralizing hydrobromic acid with strontium hydrate.

G. U.S.P.

U. P. Sometimes used in collodion emulsions to increase contrast. The anhydrous salt,  $\text{SrBr}_2$ , is sometimes used and occurs as a white deliquescent powder.

**STRONTIUM CHLORIDE,**

$\text{SrCl}_2 \cdot 6\text{H}_2\text{O}$  (crystals)  $\text{SrCl}_2$  (dry)

Fr. Chlorure de Strontium. Ger. Strontiumchlorid.

Syn. Chloride of strontia.

M. W. 266.5: Sp. G. 1.964: M. P. Loses  $6\text{H}_2\text{O}$  at  $112^\circ \text{C}$ .

Sol. in water and alcohol.

P. White needles.

Der. Calcium chloride is fused with sodium carbonate, the yield extracted with water, concentrated and crystallized.

G. U.S.P.

U. P. Used in the preparation of chloride emulsions, yielding more contrast and a shorter scale. The anhydrous salt,  $\text{SrCl}_2$ , occurring as a white powder is sometimes used.

**STRONTIUM IODIDE,  $\text{SrI}_2 \cdot 6\text{H}_2\text{O}$** 

Fr. Iodure de Strontium. Ger. Strontiumiodid.

Syn. Iodide of strontia.

M. W. 449: Sp. G. 4.415.

Sol. in water, alcohol and ether.

P. Yellowish, granular powder.

Der. By treating strontium carbonate with hydriodic acid.

G. U.S.P. Fused.

U. P. Uses, the same as for strontium bromide. (QV.)



**THIOCARBAMIDE,  $\text{CS}(\text{NH}_2)_2$** 

Fr. Sulfo-urée, Sulfocarbamide. Ger. Thiocarbamid, Sulfoharnstoff.

Syn. Sulphourea, Thiourea.

M. W. 76; Sp. G. 1.406; M. P.  $180^\circ \text{C}$ .; B. P. Sublimes in vacuo at  $150^\circ\text{-}160^\circ \text{C}$ .

Sol. in cold water, ammonium sulphocyanide solution and ether; Ins. in cold alcohol.

P. White, lustrous crystals.

Der. Obtained by heating ammonium sulphocyanide for several hours at a temperature of  $161^\circ \text{C}$ .

U. P. Used in the gold toning bath and has been suggested as an addition to eikonogen developer to produce reversal. Thiocarbamide can also be used for clearing yellow stains from prints and plates.

**THIOSINAMINE,  $\text{CS}(\text{NH}_2)\text{NHC}_3\text{H}_5$** 

Fr. Sulfophenylurée. Ger. Thiosinamin Allylsulfoharnstoff.

Syn. Allyl sulphocarbamide, Allyl sulphourea.

M. W. 116.

Sol. in alcohol and ether; Ss. in water.

P. Colorless crystals; garlic odor.

Der. Prepared by the action of ammonia and alcohol on allyl sulphocyanate (oil of mustard).

U. P. Has been tried as a fixing agent, but is not nearly as energetic as hypo.

**TIN (Stannous) CHLORIDE,  $\text{SnCl}_2\cdot 2\text{H}_2\text{O}$** 

Fr. Chlorure d'Étain. Ger. Stannochlorid.

Syn. Tin protochloride or dichloride, Tin salt.

M. W. 225. Sp. G. 2.71; M. P.  $37.7^\circ \text{C}$ .; B. P. Decomposes.

Sol. in water and alcohol.

P. White crystals.

Der. Prepared by the action of hydrochloric acid on tin.

G. Technical crystals.

U. P. Can be used as a blackening agent after bleaching with mercuric chloride.

**URANIUM CHLORIDE,  $\text{UO}_2\text{Cl}_2\cdot\text{H}_2\text{O}$** 

Fr. Chlorure d'Urane. Ger. Uranylchlorid.

Syn. Uranyl chloride or oxychloride.

M. W. 361.

Sol. in water and alcohol.

P. Deliquescent, greenish-yellow flakes; poisonous.

Der. Prepared by dissolving uranic oxide in hydrochloric acid.

U. P. Sometimes used as a sensitive salt for printing-out paper, and added to a chloride emulsion increases contrast.

**URANIUM NITRATE,  $\text{UO}_2(\text{NO}_3)_2\cdot 6\text{H}_2\text{O}$** 

Fr. Azotate d'Urane. Ger. Uranylsalpetersaure.

Syn. Uranyl nitrate, Uranium oxynitrate.

M. W. 504: Sp. G. 2.807: M. P.  $60.2^\circ\text{C}$ : B. P.  $118^\circ\text{C}$ .

Sol. in water, alcohol and ether. Poisonous.

P. Yellow, rhombic crystals; efflorescent, greenish color by reflected light.

Der. Prepared by dissolving uranic oxide in nitric acid.

G. U.S.P.

U. P. Used in printing-out emulsions and with potassium ferricyanide in the toning of bromide prints and intensification of negatives. Used in conjunction with silver nitrate in the preparation of uranium silver papers for gaslight printing. Also used in the uranium mercurio-uranotype and the platino-uranotype processes.

**VANADIUM CHLORIDE,  $2\text{VO}_2\cdot 4\text{HCl}\cdot 3\text{H}_2\text{O}$** 

Fr. Chloure de Vanade. Ger. Chlorvandium.

Syn. Hypovanadic-hydrochloride, Divanadyl-tetrachloride.

M. W. 366: Sp. G. 3.23. Sol. in water and alcohol.

P. Dark green syrupy mass; poisonous.

Der. Prepared by dissolving vanadic anhydride in hydrochloric acid.

U. P. Used for imparting a green tone to bromide prints, and is one of the ingredients of the Donisthorpe dye printing process. Lumière, in 1894, introduced a vanadium printing paper in which a gelatinized paper was sensitized with a mixture of vanadium chloride in alcohol and water, printed under a positive transparency and subsequently treated with paramidophenol.

**ZINC BROMIDE,  $\text{ZnBr}_2$** 

Fr. Bromure de Zinc. Ger. Zinkbromid.

M. W. 225: Sp. G. 4.219: M. P.  $394^\circ \text{C.}$ : B. P.  $650^\circ \text{C.}$

Sol. in water, alcohol and ether.

P. White, hygroscopic, crystalline powder.

Der. Prepared by dissolving zinc carbonate in hydrobromic acid.

G. U.S.P.

U. P. Used in the preparation of collodion emulsions.

**ZINC CHLORIDE,  $\text{ZnCl}_2$** 

Fr. Chlorure de Zinc. Ger. Zinkchlorid.

M. W. 136: Sp. G. 2.91: M. P.  $262^\circ \text{C.}$ : B. P.  $730^\circ \text{C.}$

Sol. in water, alcohol and ether.

P. White, granular, deliquescent crystals; poisonous. Keep well stoppered.

Der. By the action of hydrochloric acid on zinc, with subsequent crystallization.

G. U.S.P.

U. P. Used in the preparation of collodion emulsions.

**ZINC IODIDE,  $\text{ZnI}_2$** 

Fr. Iodure de Zinc. Ger. Zinkiodid.

M. W. 319: Sp. G. 4.696: M. P.  $446^\circ \text{C.}$ : B. P.  $624^\circ \text{C.}$

Sol. in water, alcohol and ether.

P. White, deliquescent powder. Keep well stoppered.

Der. Prepared by dissolving zinc oxide in iodic acid.

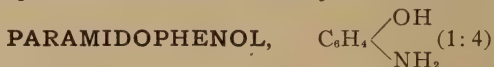
G. U.S.P.

U. P. Used in the preparation of collodion emulsions.

## DEVELOPERS

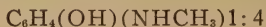
There are upwards of three hundred (300) known photographic developing agents, most of them are, however, of purely laboratory interest. Some have become obsolete and many are no longer manufactured, therefore, only the developing agents in current use will be described in this section:

Developers obtained from Monohydric Phenols:



Obtained by reducing para-nitrophenol with tin and hydrochloric acid. Occurs in colorless crystals with an M. P. of  $184^\circ \text{C.}$ , also forms a crystalline hydrochloride. "Rodinal," the concentrated liquid developer, contains para-amidophenol-hydrochloride. There is a solid form known as Unal.

### MONO-METHYL-PARAMIDO-PHENOL,



Obtained by methylating paramidophenol, and more recently by the direct synthesis of methylamine and hydroquinone.

Elon or "Metol" is the sulphate and is also known as Rhodol, Adne, Satrapol, Genol, etc. Elon or Metol in conjunction with hydroquinone is one of the best known developers. It also works well in conjunction with pyro.

### DI-AMIDO-PHENOL, $\text{C}_6\text{H}_3(\text{OH})(\text{NH}_2)(\text{NH}_2)1:2:4$

Obtained by reducing 1:2:4 dinitrophenol with tin and hydrochloric acid, forms salts with sulphuric and hydrochloric acids.

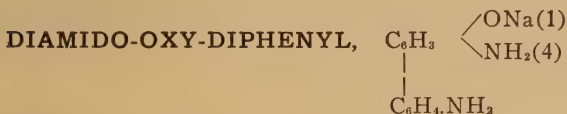
"Amidol" can be either the sulphate or chloride, and is one of the best developers for bromide and gaslight

papers. It does not keep very well in solution. Recently, methods of prolonging the life of Amidol solutions have been suggested by the addition of a small amount of lactic acid or a small proportion of metol. Amidol and Acetone sulphite form a powerful developer.

### PARA-AMIDO-SALIGENIN,



Occurs as an easily soluble white powder, somewhat similar in properties to Amidol, with the advantage of allowing the preparation of very concentrated solutions. "Edinol," made by Bayer, is the trade name of this material. It combines well with hydroquinone and acetone sulphite.



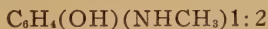
The sodium salt can be used in a manner similar to Rodinol. Is sold as "Diphenal."

### PARA-OXY-PHENYL-GLYCOCOLL,



Obtained by heating paramidophenol with monochloracetic acid in aqueous solution. "Glycin" is the trade name for this preparation. It gives a very pure black image and solutions keep well. Used principally for stand development, owing to the fact that it does not produce chemical fog with prolonged development.

### METHYL-ORTHO-AMIDO-PHENOL,



One molecule of hydroquinone with two molecules of methylorthoamidophenol forms the basis of "Ortol."

The following two naphthalene compounds are used as developers:

**SODIUM AMIDO-BETA-NAPHTHOL-MONO-SULPHONIC ACID,  $C_{10}H_5(OH)(NH_2)(SO_3Na)$**

Occurs in tabular crystals, white or slightly violet tinted. Is frequently sold blended with potassium metabisulphite. Is known commercially as "Eikonogen." Eikonogen is a useful developer for plates which have received short exposure, and works very well in conjunction with hydroquinone.

**SODIUM AMIDO-NAPHTHOL-DI-SULPHONATE,  $C_{10}H_4(NH_2)(OH)(SO_3Na)_2$**

A yellowish powder, frequently combined with metabisulphite as a preservative. This body forms the basis of the developer "Diogen." Diogen gives negatives of a good pure black color having good gradation; not very susceptible to bromide.

Developers obtained from Dihydric Phenols:

**PARA-DI-OXY-BENZINE,  $C_6H_4(OH)_2$  1:4**

The best preparation occurs as almost white crystals or needles obtained by recrystallizing the commercial product in the presence of  $SO_2$ . Is known commercially as "Hydroquinone." Hydroquinone alone gives strong, hard negatives of a bluish-black tone and is quite opposed to Metol in performance, as with Hydroquinone the shadow detail does not come up until the high lights have acquired considerable density; in other words, it produces density rather than detail, which makes it of value in combination with the softer working Metol. Can be successfully used with Edinol and Eikonogen.

**MONOCHLOR and MONO-BROM-HYDRO-QUINONE,  $C_6H_5Cl(OH)_2$  and  $C_6H_5Br(OH)_2$**

The Monochlor is prepared by leading Chlorine gas through Hydroquinone dissolved in benzol, while the Monobrom is obtained by adding a solution of bromine in benzol to a Hydroquinone benzol solution, subsequently evaporating the benzol and crystallizing from ligron. Commercially these bodies are known as "Adurol," the monobrom being the product of Schering, and the mono-



chlor, the product of Hauff. Adurol in performance comes between Hydroquinone and the rapid types of developers, such as Metol and Rodinal. Solutions are not readily oxidized and may be repeatedly used.

### **PYROCATECHOL, $C_6H_2(OH)_2$ 1:2**

Occurs as a white crystalline powder, something like Hydroquinone in appearance. Is soluble in alcohol, ether and water. Does not keep well in solution. If a 5% solution of borax be used as restrainer, very good brown-black tones may be obtained by direct development on gaslight and bromide paper. It is also sold under the name of "Kachin."

### **RESORCIN, $C_6H_4(OH)_2$ 1:3**

Is in itself of no use as a developer, but two Amido derivatives from excellent developers. "Diamido Resorcin,"  $C_6H_2(NH_2)_2(OH)_2$  and "Triamido Resorcin." Diamido Resorcin Hydrochloride is sold as "Dianine," is a fawn colored powder working similarly to Amidol, needing only soda sulphite to produce an energetic developer. Triamido Resorcin Hydrochloride is sold as "Reducin."

Developers obtained from Trihydric Phenols:

### **PYROGALLOL, $C_6H_3(OH)_3$ 1:2:3**

Familiarly known as "Pyrogallic Acid" or "Pyro," a fine, very light, white powder which oxidizes very quickly in solution. Produces negatives of a yellowish color unless sodium sulphite is used. It also stains the fingers. Used in conjunction with Metol and Hydroquinone forms an excellent tank developer, and with Metol an excellent developer for portrait negatives. The accelerators used with Pyro can be Ammonia, Sodium Carbonate, Potassium Carbonate or Acetone.

### **PINAKOL P**

Is a good developer made by substituting in the Pyro potash developer the alkali by half the equivalent amount of sodium amidoacetate. This developer works more rapidly than ordinary pyro, gives clearer negatives and does not stain the fingers.

## DYES

Of the several hundred known dyes for color sensitizing, desensitizing safe lights, mordanting processes, and the preparation of light filters, but comparatively few are really useful and practical in performance. Only those which have found continued and successful application in photographic processes will be dealt with:

### SENSITIZING DYES

For Orthochromatic Emulsions:

ERYTHROSIN is most generally used for orthochromatizing silver bromide emulsions. It sensitizes for yellow and green.

EOSIN is also used for orthochromatizing but does not give as great a sensitiveness as Erythrosin, and is more likely to produce fog in the emulsion.

The usual practice when orthochromatizing emulsions with either of these two dyes is to add them to the emulsion during the course of manufacture instead of bathing.

MONO-BROM-FLUORESC EIN is also used as a yellow-green sensitizer for silver bromide.

In the preparation of the so-called self-screened emulsions a yellow dye is incorporated with the emulsion and acts as though a yellow filter were employed upon the lens, usually this result is obtained by adding to the emulsion a small amount of Filter Yellow K.

With both Erythrosin and Eosin the sensitizing effect is greatly increased by using them in conjunction with ammonia.

For Panchromatizing Emulsions:

For Panchromatizing it is usual to employ two or more dyes to secure the desired result.

## CYANINES

CYANIN, a blue dye, is very useful as a sensitizer for silver bromide where a panchromatic effect is desired. It confers a sensitiveness to yellow, orange and red rays with a minimum of sensitiveness between E and F. Its chief disadvantage is a tendency to produce fog, and it has been almost entirely replaced by the Isocyanines.

DICYANIN sensitizes silver bromide emulsions as far as the red line A, with minimum sensitiveness between E and F. The prepared plates, however, do not keep very well.

## ISOCYANINES

ETHYL RED, which occurs as green crystals, soluble in water and alcohol, sensitizes bromide emulsions with fair uniformity from violet to red with a small minimum in the green. It does not, however, sensitize very far into the red end.

ORTHOCHROME—T is an excellent sensitizer for green, yellow, orange and red, diminishing the general sensitiveness but very little, and has no tendency to fog the emulsion.

PINACYANOL. This is one of a new class of dyes which gives great sensitiveness to yellow, orange and red. Is particularly useful in the preparation of plates for three-color photography, for recording the blue sensation. Pinacyanol does not sensitize for green and so the plates may be developed in dark green light (F line) without danger of fog. Pinacyanol may be added to an emulsion during the process of manufacture, or may be used to bathe the finished plates or films.

PINACHROM sensitizes bromide emulsions up to the line B, producing plates which render dark red extremely well; does not tend to produce emulsion fog and the finished plates will keep for a long time. This dye can either be added to the emulsion or the finished plates may be bathed.

PINACHROM VIOLET has one great advantage over Pinacyanol: in that it combines with the green sensitizers with less danger of fog and influence on the keeping quality of the finished plates. Pinachrom Violet sensitizes almost to line B. Can be added to the emulsion or used for bathing the finished plates.

PINAVERDOL is excellent for conferring green sensitiveness, and may be added to the emulsion or used for bathing the finished plate.

PINAFLAVOL is the newest sensitizer for green and combines much better with Pinacyanol than does Pinaverdol. Can be added to the emulsions or used for bathing the finished plates. Confers no red sensitiveness.

In Panchromatizing it is always found that there are definite maxima and minima of sensitiveness and recently the addition of Auramine has been suggested to the panchromatizing dyes as a means of securing a more uniform panchromatic effect. It is only necessary to use a very small amount of this dye.

KRYPTO-CYANINE sensitizes very strongly for red and has only recently been introduced. It gives a maximum sensitiveness at wave length 770; confers no green sensitiveness. Other sensitizers of this class for the deep red which have recently been introduced, are: *Beta-naphtha-cyanole*, which sensitizes with a strong maximum in the deep red at wave length 690, and also sensitizes for green but less so than Pinacyanol. *Acetaminocyanole*, when added to an emulsion yields a maximum sensitiveness at wave length 730, can also be used for bathing the finished plates.

During the war Pinacyanol and Pinaverdol were synthesized in this country at the Color Laboratory at the Bureau of Chemistry at Washington, and were also prepared in England by Prof. Pope, under the names of Sensitol Red and Sensitol Green; both the English and American dyes were in every way equal to the German product.

## DESENSITIZING DYES

Recently Lüppo-Cramer discovered the desensitizing action of the Azo dye known as Phenosafranine, and also of other dyes of the same class on ordinary and panchromatic plates. A further application of the use of Phenosafranine is the use of the substance in very small amounts for development under ruby or orange light of great brilliancy, so that even a very sensitive plate or even orthochromatic plates may be developed under the direct rays of the dark-room light. It has been found that 10 cc. of a 100,000 solution of Phenosafranine added to 100 cc. of any desired developer permits of the safe development without risk of fog, even in a very bright ruby light. In addition to Phenosafranine the following dyes of the Safranine class possess valuable desensitizing properties:

Di-methyl-pheno-safranine.

Tetra-methyl-safranine.

Tolu-safranine (ordinary safranine).

Methyl-tolu-safranine (Safranine MN).

Dimethyl-benzoxyl-safranine (Giroflé).

Tetra-ethyl-phenosafranine (Amethyst violet).

Creso-safranine.

Naphtho-phenosafranine.

Ethyl-dimethyl-etho-safranine (Fast neutral violet D).

The following bodies also exert a strong desensitizing action:

Toluylene red, 1:1,000 solution; immersion for 4 minutes.

Aurantia (ammonium salt), 1:1,000 solution.

Picric Acid, 1 per cent. solution.

Indian Yellow, 2 per 1,000 solution.

Crysoidine, 1:2,000 solution.

Diamidophenol, 1 per cent. solution.

Apomorphine hydrochloride, 1 per 1,000 solution.

Neutral potass chromate, 2 per cent. solution.

Plates may also be desensitized with Potassium Iodide according to Freund's method. This method is not very satisfactory.

## FILTER DYES

Recently Hnatek has given a very complete collection of dyes and their applications for filter-making that cover the whole of the spectrum and are applicable to all classes of photographic work where contrast or compensating filters and safe lights are necessary:

# A. FILTERS WITH A TRANSMISSION OF ABOUT 1000 ÅNGSTRÖM'S UNITS

1. Violet-4900	Hofmann's violet	3.0	cc.	3.0	gm.	red from 6800
2. Violet-4800	(a) Yellowish eosin	2.0	cc.	4.0	gm.	
	(b) Methylene blue 4 B	2.0	cc.	1.0	gm.	red from 7000
3. 4500-5600	(a) Chinoline yellow	1.0	cc.	1.0	gm.	
	(b) Patent blue	2.0	cc.	2.0	gm.	weak red from 7000
4. 4800-5900	(a) Auramin O	3.0	cc.	3.0	gm.	
	(b) Naphthol green	1.0	cc.	1.0	gm.	
	Light green S	1.5	cc.	1.5	gm.	
5. 5200-6400	(a) Tartrazine	1.0	cc.	2.0	gm.	
	(b) Naphthol green	2.0	cc.	2.0	gm.	
6. 5500-6500	(a) Brilliant orange	4.0	cc.	2.0	gm.	
	(b) Naphthol green	2.0	cc.	2.0	gm.	
7. 5600-6600	(a) Yellowish eosin	1.0	cc.	2.0	gm.	
	Tartrazine	2.0	cc.	4.0	gm.	
	(b) Naphthol green	1.0	cc.	1.0	gm.	
8. 5900-6900	(a) Fast red D	2.0	cc.	2.0	gm.	
	(b) Tartrazine	1.0	cc.	2.0	gm.	



**B. FILTERS WITH A TRANSMISSION OF FROM  
500 TO 900 Å. U.**

9.	3900-4500	(a) Yellowish eosin (b) Methylene blue 4 B	2.0 cc. 2.0 cc.	4.0 gm. 1.0 gm.	red from 7000
10.	3900-4600	(a) Bluish eosin (b) Methylene blue 4 B	1.5 cc. 2.0 cc.	3.0 gm. 1.0 gm.	red from 7000
11.	4450-5100	(a) Filter yellow K (b) Alkali blue 6 B	1.0 cc. 1.0 cc.	1.0 gm. 1.0 gm.	weak red from 6800
12.	4800-5500	(a) Auramin O (b) Methylene blue 4	2.0 cc. 1.5 cc.	2.0 gm. .75 gm.	red from 7200
13.	5100-5700	(a) Tartrazine Naphthol green (b) Acid green J E	1.0 cc. 1.0 cc. 1.25 cc.	1.0 gm. 1.0 gm. .5 gm.	
14.	5600-6300	(a) Tartrazine Naphthol green (b) Yellowish eosin	1.0 cc. 2.0 cc. 2.0 cc.	2.0 gm. 2.0 gm. 4.0 gm.	
15.	5800-4600	(a) Rose Bengal (b) Tartrazine Naphthol green	2.0 cc. 1.0 cc. 1.5 cc.	2.0 gm. 2.0 gm. 1.5 gm.	
16.	6000-6600	(a) Fast red D Tartrazine (b) Naphthol green	2.0 cc. 1.0 cc. 1.0 cc.	2.0 gm. 2.0 gm. 1.0 gm.	

## C. FILTERS WITH A TRANSMISSION OF FROM 200 TO 500 Å. U.

17.	4250-4650	(a) Bluish eosin (b) Patent blue A	1.5 cc. 3.0 gm. 4.0 cc. 4.0 gm.	weak red from 7200
18.	4600-4800	(a) Chinolin yellow (b) Gentian violet	2.0 cc. 2.0 gm. 3.0 cc. 1.5 gm.	red from 6500
19.	4700-4800	(a) Chinolin yellow (b) Naphthol green (c) Gentian violet	3.0 cc. 3.0 gm. 2.0 cc. 2.0 gm. 4.0 cc. 2.0 gm.	fairly dark
20.	4800-5300	(a) Naphthol yellow (b) Alkali blue 6 B	2.0 cc. 2.0 gm. 1.5 cc. 1.5 gm.	faint red from 6600
21.	4900-5200	(a) Naphthol yellow (b) Alkali blue 6 B	3.0 cc. 3.0 gm. 2.0 cc. 2.0 gm.	faint red from 6700
22.	5050-5500	(a) Tartrazine (b) Patent blue	1.0 cc. 2.0 gm. 3.0 cc. 3.0 gm.	faint red from 7100
23.	5200-5400	(a) Brilliant orange (b) Naphthol green	4.0 cc. 2.0 gm. 2.0 cc. 2.0 gm.	
24.	5200-5700	(a) Martius yellow (b) Patent blue	4.0 cc. 1.0 gm. 1.5 cc. 1.5 gm.	faint red from 7000
		or		
		(a) Martius yellow (b) Brilliant green	2.0 cc. 1.0 gm. 2.0 cc. 1.0 gm.	faint red from 7000

25.	5400-5800	(a) Brilliant orange (b) Naphthol green Patent blue	2.0 cc. 1.0 cc. 1.0 cc.	1.0 gm. 1.0 gm. 1.0 gm.
26.	5700-6000	(a) New coccin (b) Naphthol green Patent blue	1.0 cc. 1.0 cc. 0.5 cc.	2.0 gm. 1.0 gm. .5 gm.
27.	5950-6450	(a) New coccin (b) Naphthol green	2.0 cc. 1.5 cc.	4.0 gm. 1.5 gm.
28.	6100-6600	(a) Bordeaux (b) Tartrazine Naphthol green	3.0 cc. 1.0 cc. 1.0 cc.	3.0 gm. 2.0 gm. 1.0 gm.
29.	6500-6800	(a) New coccin Naphthol green (b) Gentian violet	2.0 cc. 0.75 cc. 1.0 cc.	4.0 gm. .75 gm. .5 gm.
30.	6500-red	(a) New coccin (b) Hofmann's violet	2.0 cc. 1.0 cc.	4.0 gm. 1.0 gm.
31.	6750-red	(a) Fast red D Tartrazine (b) Methyl green	2.0 cc. 1.0 cc. 2.0 cc.	2.0 gm. 2.0 gm. 2.0 gm.
32.	6900-red	(a) Fast red D Tartrazine (b) Patent blue	3.0 cc. 1.0 cc. 2.0 cc.	3.0 gm. 2.0 gm. 2.0 gm.

The dyes were made up into stock solutions of the following strengths:

0.4-100 Acid green.

0.5-100 Brilliant orange, martius yellow, brilliant green, methyl green, methylene blue, toluidin blue, gentian violet.

1-100 Fast red, D. Bordeaux, rose bengal, naphthol yellow, chinolin yellow, rapid filter yellow K, auramin, naphthol green, light green, alkali blue, patent blue, Hofmann's violet.

2-100. New coccin, eosin, tartrazine.

The second column gives the band of transmission of the filter, the fourth gives the number of cubic centimeters that should be added to 7 cc. of 12 per cent. solution of gelatin, and this is the quantity that should be coated on 100 square centimeters of glass.

The fifth column gives the quantity of dry dye in grams per square meter, according to Huebl, which is called the density of the dye.

The last column gives useful data as to the transmission of the red end of the spectrum, which for visual work is negligible, but for photographic work must be taken into consideration, when panchromatic plates are used.

Filters 9, 29 and 32 are rather dark, that is to say, they exert some absorption of the region that they generally transmit; 10, 17, 28 and 31 are less dark, but still do not transmit to the full the wave lengths given.

It is obvious that by combination of two or more filters almost monochromatic filters can be obtained, but in all cases the resultant filters are very dark.

The signs (a) and (b) mean that the dyed gelatine must be coated on two separate glasses and that they cannot be mixed.

For the preparation of orthochromatic filters similar to the K series, Filter Yellow K is the dye used. A filter about equivalent to K2 can be prepared as follows:

Gelatine solution .....	6%
Filter Yellow K.....	1 to 200 sol.
(Rapid Filter Yellow)	

For Orthochromatic Emulsions:

Gelatine solution .....	120 cc.
Dye solution .....	36 cc.
Water .....	6 cc.

Use 7 cc. of dyed gelatine to 1 sq. decimeter plate surface and use two of the coated glasses cemented together, or use 14 cc. dyed gelatine to 1 sq. decimeter and cement to a plain glass.

Lighter or darker filters may of course be obtained by decreasing or increasing the amount of dye. Filter Yellow K may be replaced by the English dye (Ilford Ltd.) Filter Yellow A.

## FILTERS FOR THREE COLOR WORK

### Stock Solutions:

Blue—

Crystal Violet .....	4 grams
Dist. water to.....	350 cc.
Glacial Acetic Acid.....	5 or 6 drops

Green—

Filter Blue Green .....	1 gram
Filter Yellow K.....	1 gram
Water to .....	100 cc.

Red—

Rapid Filter Red I.....	5 grams
Water to .....	200 cc.

Dyed Gelatine—

Dye Solution .....	20 cc.
Gelatine Solution 6%.....	100 cc.
7 ccs. to 100 sq. cm.	

Cement two of each filter together.

**DARK ROOM FILTERS—BASED ON 16 C. P. LAMP****For use with Developing Papers:**

Transmits 515 to 800

Tartrazine ..... 0.8 grams

Gelatine Sol. 6%..... 60.0 cc.

Coated on a glass 8 x 10. Bind two together with onion skin paper between.

**For Bromide Papers and Lantern Plates:**

Transmits 575 to 800

Glass No. 1—

Gelatine Sol. 6%..... 60.0 cc.

Tartrazine ..... 0.8 grams

Glass No. 2—

Gelatine Sol. 6%..... 60.0 cc.

Rose Bengal ..... 0.3 grams

Bind 1 and 2 with tissue—8 x 10 glass.

**Rapid Ordinary Plate**

Transmits 620 to 800

Glass No. 1—8 x 10

Gelatine Sol. 6%..... 60.0 cc.

Tartrazine ..... 0.8 grams

Glass No. 2—

Gelatine Sol. 6%..... 60.0 cc.

Xylene Red ..... 0.8 grams

Bind with tissue. To darken soak the tissue in Methyl Violet solution; use double quantity. Trans. 650 to 800. Suitable for ortho emulsions.

The equivalents in other dyes of 0.8 grams of tartrazine:

Brilliant Yellow ..... 0.4 grams

Naphthol Yellow ..... 0.8 grams

Auramine Yellow ..... 1.6 grams

Instead of Xylene Red 0.8, may use 0.6 grams Rose Bengal.



**Green for Panchromatic Plates**

Naphthol Green .....	1 gram
Filter Blue 1:1000 sol.....	4 cc.
Gelatine 6% sol.....	90 cc.

Use 7 cc. to 100 sq. cm. of glass. Bind two together with tissue

**DYES FOR TINTING MOTION PICTURE FILM,  
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A number of dyes are supplied especially for tinting or staining. Those most frequently used for motion picture positives being Cine Red, Cine Scarlet, Cine Orange, Cine Yellow, Cine Green and Cine Blue.

The following dyes made by the National Aniline Chemical Company are also used for tinting films: Safranine 6B, Methylene Blue SP, Methyl Violet 2B Conc. Pdr., Chrysoidine Y Extra, Safranine A, Victoria Green WB Pdr., Auramine O, Fuchsine NB Pdr. Almost any tint can be obtained by the proper combination of two or more of these dyes.

### CONVERSION TABLES

With Weights and Measures

Millimeter.....	0.04	inch
Centimeter.....	0.39	inch
Inch.....	2.54	cm.
Foot.....	0.3048	meter
Yard.....	0.9144	meter
Mile.....	1.6093	kilometer
Meter.....	39.37	inches
Meter.....	3.2808	feet
Meter.....	1.0936	yards
Kilometer.....	0.6214	mile
Square Inch.....	6.45	sq. cm.
Square Foot.....	0.0929	sq. meter
Square Yard.....	0.836	sq. meter
Ounce Avoirdupois.....	28.35	grams
Ounce Troy and Apothecaries.....	31.103	grams
Pound Avoirdupois.....	453.59	grams
Pound Troy.....	373.2	grams
Gram.....	15.432	grains
Kilogram.....	2.205	lbs. Avoir.
Kilogram.....	2.679	lbs. Troy
Ounce (fluid).....	29.574	cc.
Quart.....	0.9464	liter
Gallon U. S.....	3.7854	liters
Liter.....	1.0567	quart
Liter.....	0.2642	gallon
Cubic Inch.....	16.387	cc.
Cubic Foot.....	28.3	liters
Ounce Avoirdupois.....	437.5	grains
Ounce Troy and Apothecaries.....	480.0	grains
Gallon U. S.....	231.0	cu. inches
Gallon U. S. Water.....	8.337	lbs.
Cubic Foot.....	7.48	gallons
Cubic Foot Water.....	62.426	lbs.

### CONVERSION RULES

Grams per liter into grains per ounce:

Multiply the grams by 0.44.

Ccs. per liter into minims per ounce:

Divide the ccs. by 2 (more exactly, multiply by 0.48).

Grains per ounce into grams per liter:

Multiply the grains by 2.3. Thus 50 grs. per oz. = 115 gms. per liter.

Minims per ounce into ccs. per liter:

Multiply the minims by 2.

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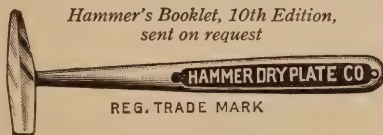
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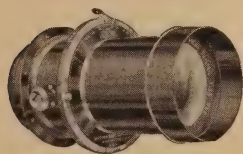
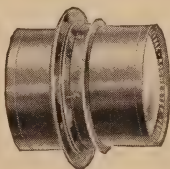


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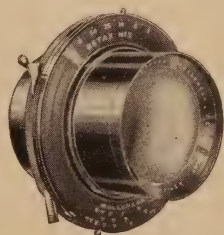


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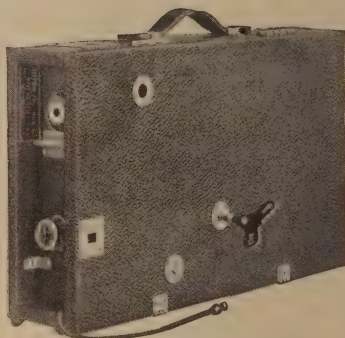
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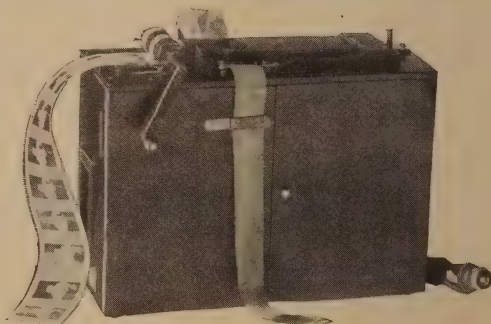
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